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1. *Hemaris luciformis*.
2. " *tityus*.
3. *Macroglossa stellatarum*.
4. do. do., larva

Q2
5.12
N53
V.4
LLOYD'S NATURAL HISTORY.

EDITED BY R. BOWDLER SHARPE, LL.D., F.L.S., &c.

A HAND-BOOK
TO THE
ORDER
LEPIDOPTERA.

BY
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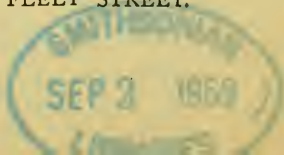
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EDITOR'S PREFACE.

MR. KIRBY has so fully explained the plan pursued in issuing the present volume of the "Naturalist's Library" that I need only refer the reader to the accompanying "Preface" which he has written.

In any case, it seems better to publish the bibliographical chapter here, than to divide the great group of *Noctuæ* into two parts, and place half of them in vol. iv. and the other in vol. v. I have consequently kept the *Noctuæ* intact for the latter volume, and have issued all the bibliographical work, and other general articles written by Mr. Kirby originally for the fifth volume, in the present one.

R. BOWDLER SHARPE.

January 20th, 1897.

AUTHOR'S PREFACE.

THE fourth volume of the Handbook of *Lepidoptera* deals with a limited number of families, and completes our synopsis of the Moths roughly classed as Sphinges and Bombyces, with the exception of the *Sesiidæ*, or Small Clear-wings, which will be discussed later. The families at present under review are among those which include many of the largest and handsomest, as well as some of the most valuable, of the Moths; such as the *Sphingidæ*, or Hawk-moths proper; the *Bombycidæ*, or true Silkworm Moths; and the *Saturniidæ*, or Atlas and Emperor Moths, which may also be called Ocellated Silkworm Moths. The silk of many of the larger species is of great economic importance in the countries where they are found, being locally of almost equal value with that produced by the true silkworms. Of the *Sphingidæ* we have been able to figure all the British species, and a selection of foreign ones; while among the *Saturniidæ* we have figured our own Emperor Moth (the sole British representative of the family) and various foreign species, including two of the most typical Indian Silkworm Moths, with their larvæ. This volume likewise includes representatives of two remarkable families not represented in Europe, the *Ceratocampidæ* and *Pinaridæ*, as well as several other European and exotic families of Moths,

two of which are of peculiar interest on account of their habits and structures—viz., the *Zeuzeridæ* and *Hepialidæ*, the latter being considered by many Entomologists to be the most archaic group of all existing *Lepidoptera*, except the *Micropterygidæ* and *Eriocephalidæ*.

As vol. v. is intended to include the whole of the remaining families of *Lepidoptera*, no space would have been available for other matter than the descriptive part of the work, unless room had been found for it by transferring a considerable portion of our account of the *Noctuæ* to the present volume. It was, however, considered undesirable by the Editor to divide the *Noctuæ* in this manner, and therefore, instead of publishing part of the *Noctuæ* in vol. iv. and the remainder in vol. v., in addition to the remaining families, it was decided to adhere to the scheme set forth in the Preface to vol. iii., and to issue with the present volume the whole, or nearly the whole, of the supplementary matter, part of which was originally intended to appear in vol. v.

Vol. iv., therefore, includes three sections besides the descriptive portion. The first is Professor Westwood's letter, referred to in the "Preface" to our vol. i., giving full particulars of his work for Jardine's "Naturalist's Library." It was important to place this letter on permanent record in the present work, and the Editors of the "Entomologist's Monthly Magazine" have kindly permitted me to reprint it.

The second section contains a sketch of the various systems of classification of the *Lepidoptera*, as advertised in the "Preface" to our last volume; and the third section, which was originally

intended to appear in vol. v., but which now forms the concluding section of vol. iv., embraces a short sketch, limited to systematic and faunistic works, of the bibliography of *Lepidoptera*. In consequence of the amount of extra matter, it has been decided to give a fuller subject-index than in the earlier volumes of the series.

It is not pretended that the essays on Classification or Bibliography are exhaustive; and some books have been excluded from the latter solely to avoid repetition, because they are noticed in other parts of the work. It is hoped, however, that these chapters will be useful to students who wish to take up the study of *Lepidoptera* from a more serious point of view than that of mere collectors or amateurs.

Finally, attention has recently been called to the reckless manner in which some collectors virtually exterminate local insects: and the Entomological Society of London has appointed a committee to consider the subject. It is the duty of every right-feeling Entomologist (even if only an amateur, and whether collecting at home or abroad) not to kill a single specimen more than he actually requires for scientific purposes. Nor is there any reason to object to an Entomologist being only an amateur, or, as it is sometimes termed, "a mere collector," for the range of Entomology is vast, and there is plenty of room for workers in all directions. A Lepidopterist may not admire a fly or a beetle, but he need not look down on those who do; and a systematist need not underrate the work of a physiologist, or *vice versâ*. Specialism there must be in all branches of science, but there need not

be narrowness or exclusiveness in our work ; and at the risk of being thought a preacher, I am anxious to impress more enlarged views on the minds of those of the younger generation of Entomologists who are willing to read this Preface to the end.

W. F. KIRBY.

Chiswick, January, 1897.

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INTRODUCTORY ESSAYS
TO VOL. IV. OF
LLOYD'S NATURAL HISTORY
(LEPIDOPTERA).

No. I.

*On the Authorship of the Letterpress of Volumes
I., VI., and VII. of the Entomology in
"Jardine's Naturalist's Library."*

[Some uncertainty existing in respect to Professor Westwood's share in the authorship of the volumes on Entomology in "Jardine's Naturalist's Library," Mr. Stainton wrote to Professor Westwood on the subject, and received in reply the following letter, which was published in the "Entomologists' Monthly Magazine" for January, 1886 (vol. xxi. pp. 182-186). This letter is here reprinted in its entirety, by the kind permission of the present editors of the Magazine, but it has not been thought necessary to reprint the observations prefixed to it by Mr. Stainton (*op. cit.* pp. 181, 182), as they are merely explanatory of the circumstances which led him to enquire into the matter.]

WALTON MANOR, OXFORD,

December 1st, 1884.

Your enquiry concerning my *Scopelodes unicolor* affords me an opportunity, of which I am glad to avail myself, of setting

myself right with my brother Entomologists, as to the extent of my share in the production of the seven volumes on Entomology forming a portion of "The Naturalist's Library, by Sir William Jardine," namely :—

"Introduction to Entomology, vol. i., by James Duncan, M.W.S.," 1840.

"Entomology, vol. ii., Beetles, by James Duncan, M.W.S.," 1835.

"Entomology, vol. iii., British Butterflies, by James Duncan, M.W.S.," 1835.

"Entomology, vol. iv., British Moths, Sphinxes, &c., by James Duncan, M.W.S.," 1836.

"Entomology, vol. v., Foreign Butterflies, by James Duncan, M.W.S.," 1837.

"Entomology, vol. vi., Bees," 1840.

"Entomology, vol. vii., Exotic Moths, by James Duncan, M.W.S.," 1841.

I may say, at starting, that of volumes ii., iii., iv., and v., I know no more of their authorship than is given on their respective title-pages as above, and that I had no personal acquaintance with Mr. Duncan, never having, to my knowledge, even seen him, and certainly he never saw one of the insects, which were published for the first time in the Naturalist's Library from my drawings. With the view of giving to some portion of the other entomological volumes an amount of originality which was wanting in the majority of the volumes of the work, I was applied to in the years 1840 and 1841 to furnish drawings of new and beautiful species of insects for the Introductory Volume, the volume on Exotic Moths, and some exotic bees for the volume on "Honey and other Bees."

These additional species were selected by myself from the collection of the Rev. F. W. Hope and my own, and the drawings, with a popular description of each species (not, how-

ever, accompanied by a technical Latin character) were forwarded by me to Edinburgh, but, unfortunately, I never saw a proof either of the plates which contained my figures or of the text, in which my descriptions were introduced by Mr. Duncan without any indication of which was mine or what his own comments.

THE INTRODUCTION TO ENTOMOLOGY, VOL. I., commences with an "Advertisement" (as was also the case throughout the Work) containing a notice of forthcoming volumes and notes of others already published. In this advertisement we read, in reference to the unpublished volume on Exotic Moths, that "drawings of new and splendid species of moths are now in preparation by Mr. Westwood, to whose elegant pencil we have likewise, as will be seen, been largely indebted on the present occasion in the volume which this accompanies."

My share in the first volume was as follows:—

Plate vi. was occupied by structural outlines of the chief characters of the Order *Orthoptera*, including a figure of "*Acheta arachnoides*" described on page 248, where we are informed "Mr. Westwood has given it the specific name of *arachnoides*."

Plate ix. contained my figure of "*Deroplatys disiccata*," properly described in the text, p. 234, as *Mantis* (*Deroplatys*) *desiccata*, West.

Plate xiv. contained my figure of "*Anostostoma Australasiæ*," stated (in p. 255) to have been first described by Mr. Grey (George Robert Gray), in Mag. Nat. His., N. Ser. i., 143.

Plate xviii. contained figures of the leading characters of the Heteropterous *Hemiptera* (described on p. 269), and of the *Homoptera* (on p. 270), with a figure of "*Polyneura ducalis*," described in the text, p. 277, as *Cicada* (*Polyneura*) *ducalis*, "and considered by Mr. Westwood as forming a distinct subgenus."

Plate xx., fig. 3, "*Anisosceles hymeniphæra*" (unique in my

collection). At p. 275 we read "for a figure and the following notice of this new species of *Anisosceles* we are indebted to Mr. Westwood."

Plate xxiv., fig. 1, "*Aphana submaculata*" noticed on p. 284.

Plate xxv., figures of *Centrotus globularis* and *C. furcatus*, together with a new species. "Mr. Westwood names it *C. biclavatus*," p. 286.

Plate xxvi., figures 1-14. Details of the leading characters of the *Neuroptera* from *Libellula*, in the description of which, p. 288, the Plate is misquoted xxvii., the word "*trophian*" is a misprint for "*trophii* are," "*Rhenarium*" is a misprint for "*Rhinarium*," and p. 289, "labrum" is a misprint for "labium"; figs. 15-23 give the details of the *Hymenoptera*; and fig. 24 represents *Joppa antennata* (p. 315), Fab. Syst. Piez., 122.

Plate xxvii., fig. 3, *Nemoptera angulata* (p. 293), "West.; Tran. Ent. Soc. vol. i., p. 75."

Plate xxviii., fig. 2, *Stilbopteryx costalis* (p. 294), Newman; Ent. Mag., No. 24, p. 400, here figured for the first time.

Plate xxxvii., fig. 1, *Asilus abdominalis*, and described p. 329 as *Asilus* (*Blepharotes*, West.) *abdominalis*; fig. 2, *Acanthomera immanis* (p. 331), Wiedemann.

[This Plate is referred to in the text as Plate xxxv., which it really is in numeral order, following immediately after Plate xxxiv., and being the last in the volume.]

ENTOMOLOGY, VOL. VI., Honey and other Bees, 1840.

No author's name is given on the title-page, but an anonymous reverend writer is stated in the "Advertisement" to have supplied the literary details respecting the Honey-bee, and Mr. Duncan's name is given, who is said to have "availed himself of the invaluable assistance of Mr. Westwood for drawings and descriptions of various figures, which now, in some cases, appear before the public for the first time."

Plate xvi., figs. 1, 2, Orange-tailed Bee (*Bombus lapidarius*, Linn., m. & f.), fig. 3, Moss or Carder Bee (*Bombus muscorum*, Linn.).

Plate xvii., fig. 2, Great Humble-bee of Valparaiso (*Bombus grandis*, Guérin, Iconogr.), p. 256.

Plate xviii., fig. 1 and p. 256, Harris' Humble-bee (*Bombus Harrisellus*, Kirby); fig. 2 and p. 257, *Apathus vestalis*, Kirby; fig. 3 and p. 259, *Apathus rupestris*, Fabricius.

Plate xix., fig. 2 and p. 262, *Euglossa analis*, fig. 3 and p. 263, *Aglæ ærulea*, Enc. Méth.

Plate xx., fig. 1, *Centris nobilis*, "named by Westwood," p. 264.

Plate xxi., fig. 1, *Xylocopa teredo*, Lansdowne Guilding, male; fig. 2, female; fig. 3 and p. 270 *Xylocopa corniger*, West.

Plate xxiii., fig. 2, *Xylocopa tenuiscapa*, and p. 271, *Xylocopa* (*Platynopoda*, West.), *tenuiscapa*, West.

ENTOMOLOGY, VOL. VII., Exotic Moths by James Duncan, M.W.S., 1841.

In the Advertisement, p. xi., we read "For many of the illustrations we have been indebted, as on former occasions, to Mr. Westwood. Two of these have reference to the illustrious subject of the memoir (Latreille). One exhibits his Cemetery (*sic*) in Père la Chaise, the other is a *fac-simile* of the Notes attached to his dissections of insects. There are many hundreds of these in existence, chiefly of *Coleoptera*."

[This collection of Latreille's Notes was given to me by the late A. Melly, each note containing the actual dissections, chiefly of the mouth organs, of a genus, descriptions of the same in Latreille's small cramped hand-writing, and rude sketches of various of the organs dissected. The collection is now preserved in the Hopeian Museum.—J. O. W.]

Of the Plates of Moths contained in this volume—

Plate ii., fig. 1 and p. 83, is an original figure of *Agarista*

picta, Leach, Zool. Misc. ; fig. 3 and p. 88, *Eusemia maculatrix* (West., n. sp.).

Plate iii., fig. 1, *Eterusia tricolor*, Hope, Linn. Trans. ; fig. 2, *Erasmia pulchella*, Hope, Linn. Trans. ; fig. 3, an original figure of *Phalæna sanguiflua* of Drury, formed by me into a new genus *Amesia* (p. 93).

Plate viii., fig. 4, *Zeuzera minea*, Cramer.

Plate xiii. and p. 138, *Saturnia Isis*, Westwood.

Plate xxiii., fig. 1, *Hypercompa*? (*Hypercampa* in plate) *Sybaris*, Cramer.

Plate xxiv., fig. 2 and p. 193, "*Cydosia nobilitella*, Westwood" (*Phalæna nobilitella*, Cramer, pl. 264).

Plate xxviii., fig. 1 and p. 220, "*Epidesmia tricolor*, Westwood"; fig. 2 and p. 222, "*Scopelodes unicolor*, Westwood."

Plate xxix., fig. 1 and p. 209, "*Asthenia Podaliriaria*, Westwood;" fig. 2 and p. 212, "*Macrotis netrix*, Westwood," *Phalæna netrix*, Cramer, pl. 151.

Plate xxx., fig. 1, *Dichroma equestralis*—in the description, p. 224, line 6, for "reflexed" read "deflexed," and in p. 226 line 10, for "head, wings" read "hind-wings." Fig. 2 and p. 227, *Dichroma histrionalis* ; fig. 3, p. 228, *D. arcualis*.

The above are all the figures, which I contributed to the Naturalist's Library, and in most instances my name is added at the foot of each plate in which my drawings were engraved, even where figures from Cramer or other previous works were engraved on the same plates as mine. Sometimes, however, my name is not added at the foot of a plate which contained my drawings, as in the volume of Exotic Moths, Plate xxviii.

I am sorry to trouble you with all these technicalities, but I quite agree with you that it is better they should be given, to avoid other enquiries of a similar nature at a future time, when no such explanation could be given.

J. O. WESTWOOD.

No. II.

On the Systems of Classification of Moths.

The natural arrangement of insects, and especially of *Leptodoptera*, has always been regarded as presenting great difficulties. The latter are covered with a thick coating of hair and scales, which must be removed before we can even obtain more than a superficial idea of their external structure; the species are numbered by tens of thousands, and without a careful comparison of characters it is impossible for us to ascertain either their importance, or how far they hold good for genera, species, or even for individuals; and finally, Butterflies and Moths pass through four very distinct phases of existence; and, as regards the larva state especially, many species differ extremely in form and structure, when the larva newly emerged from the egg is compared with the larva of the same species when about to assume the pupa state. Add to this, that perfect insects which greatly resemble each other, and would naturally be classed near each other, sometimes prove, when reared, to proceed from larvæ differing in the most fundamental characters; that the transformations of the greater number, especially of the foreign species, are wholly unknown, and that our observations, even of the few that are known, are often confined to the full-grown larvæ only; and it will be sufficiently obvious how much still remains to be done in this department of Entomology. Here and there an Entomologist like Herold or Lyonnet has devoted a life-time to the study of the transformations of a single insect, such as the Cabbage Butterfly, or

the Goat Moth, while fresh lines of inquiry and investigation, of which the older writers never dreamed, are opening up before us every day. And yet it is easy to go too fast and too far. It is futile to dogmatise on the lines of descent of *Lepidoptera* when so few fossil forms have yet been discovered to lend us any assistance in checking our conclusions; and what is called "mimicry" is apparently, in many cases, nothing more than the influence of similar surroundings, acting in a similar manner upon different insects inhabiting the same district.

Still, it may be well to sketch out very briefly the efforts made from time to time by Lepidopterists to arrive at a natural classification of the Moths, and this I will now attempt to do.

In 1758 Linnæus arranged the Moths as follows, in the 10th edition of his "Systema Naturæ":—

SPHINX. *Antennæ* medio crassiores s. utrinque extremitate attenuatæ, subprismaticæ.

Alæ deflexæ (volatu graviore vespertino s. matutino).

* LEGITIMÆ: *Alis* angulatis.

* * LEGITIMÆ: *Alis* integris, ano simplici.

* * * LEGITIMÆ: *Alis* integris, ano barbato.

* * * * Adscitæ: habitu et Larva diversæ.

PHALÆNA. *Antennæ* setacæ a basi ad apicem sensim attenuatæ.

Alæ (sedentis) sæpius depressæ (volatu nocturno).

Phalænæ dividendæ, quo facilius inquirentur.

Primariæ *Alis* incumbenti depressis.

I. BOMBYCES. *Antennis* Pectinatis.

— — Elingues absque lingua manifeste spirali.

— — — læves, dorso nec cristatæ.

1. BOMBYCES. *Antennis Pectinatis* (continued).
 - — — — *Alis patulis.*
 - — — — *Alis reversis.*
 - — — — *Alis deflexis.*
 - — — *cristatæ dorso fasciculis exasperato.*
 - — *Spirilingues Lingua involuto-spirali.*
 - — — *læves Alis patulis.*
 - — — — *Alis deflexis.*
 - — — *cristatæ dorso.*
2. NOCTUÆ. *Antennis setaceis, nec pectinatis.*
 - — *Elingues.*
 - — *Spirilingues : læves dorso.*
 - — — — — *cristatæ dorso.*
3. GEOMETRÆ. *Alis patentibus horizontalibus quiescentes.*
Pectini cornes : alis posticis angulatis s. dentatis.
alis posticis rotundatis integris.
Seti cornes : alis angulatis.
alis rotundatis.
4. TORTRICES. *Alis obtusissimis ut fere retusis, planiusculis.*
5. PYRALIDES. *Alis conniventibus in figuram deltoideum fortificatum.*
6. TINEÆ. *Alis convolutis fere in cylindrum, fronte prominulo.*
7. ALUCITÆ. *Alis digitatis fissis ad basin.*

No alteration was made in the 12th edition of the “*Systema Naturæ*,” except by the sub-division of the *Bombyces*, through the addition of the *Attaci*. The groups now run from 1 to 8 instead of from 1 to 7 ; groups 1 and 2 being as follows :—

1. ATTACI. *Alis patulis inclinatis.*
 - *Pectinicornes elingues.*
 - — — *spirilingues.*
 - *Seticornes spirilingues.*

2. BOMBYCES *alis incumbens* : *Antennis Pectinatis*.— Elingues : *absque lingua manifeste spirali*.— — *Alis reversis*.— — *Alis deflexis*.— Spirilingues : *Lingua involuto-spirali*.— — *laeves*.— — *cristatæ dorso*.

This system came into general use during the latter half of the eighteenth century. Linnæus and some of his followers used a trinomial nomenclature, generally writing "Phalæna Bombyx," "Phalæna Noctua," &c. before each name; but others wrote simply, "Phalæna." In quoting authors who adopted the former system I think it most convenient, and less misleading, to drop the word *Phalæna*, and to write "Bombyx" or "Noctua," as the case may be, than to drop these words and write only "*Phalæna*" before the specific name, as is usually done.

We must not omit to notice that Linnæus adopted a system of uniform terminations for some of his groups; thus, the species of the third section of the *Sphinges* received names like *fuciformis*, *apiformis*, &c.: the names of the *Geometræ* were made to end in *-aria* or *-ata*, those of the *Tortrices* in *-ana*, of the *Pyræles* in *-alis*, of the *Tineæ* in *-ella*, and those of the *Alucitæ* in *-dactyla*.

This system has been largely adopted, and when sensibly and fairly carried out, is a very useful aid to the memory. Unfortunately, however, some Entomologists regard the practice as childish, and refuse to conform to it in any way, while others have carried it out in the most absurd manner. Thus, two Entomologists have been honoured by having their names applied to moths in the guise of *Sesia schmidtiformis*, and *Pterophorus millieridactylus*; and Walker, in applying classical names to *Pyræles*, simply added *-alis* to them indiscriminately, so that we

meet with such names as *Botys theseusalis*, *B. siriussalis*, &c., on page after page of this portion of his Catalogue.

In 1776, Denis and Schiffermüller published their "Systematisches Verzeichniss der Schmetterlinge der Wienergegend" (a book frequently quoted simply as "S. V." or "W. V." by authors), in which they laid great stress on the importance of larval characters in classification. Their arrangement of the moths corresponded fairly with that of Linnæus; but they placed the Butterflies *after* instead of before the Moths, completely re-arranging the groups. Thus, after the *Alucitæ*, the Papiliones follow thus:—

Plebeji (= Hesperiidæ).

Heliconii (= Parnassius).

Equites (= Equitidæ).

Danai candidi (= Pieridæ, pt.).

„ flavi (= Colias and Eurymus).

Nymphales gemmati (= Satyrinæ).

„ versicolores (= Apatura).

„ maculatofasciati (= Limenitis, &c.).

„ angulati (= Vanessa, &c.).

„ nobiles (= Argynnis and Brenthis).

„ variegati (= Melitæa and Nemeobius).

„ rutili (= Lycæna).

„ polyophtalmi (= Polyommatus, &c.).

„ subcaudati (= Thecla, &c.).

„ ambigui (= Ascalaphus, Fabr., a genus of Neuroptera).

At the end of the eighteenth and at the beginning of the nineteenth century, the old Linnean groups began to be divided into genera by Fabricius, Schrank, and Latreille. They often altered the work of their predecessors arbitrarily, and while laying the foundation of our present system of nomenclature,

also introduced much of the confusion which we are, at the present day, trying to eliminate.

The subdivision of genera was carried to the farthest extent by Hübner, who tried several experiments in nomenclature; but his "Verzeichniss bekannter Schmetterlinge" was ignored by his contemporaries, for the necessity for so extensive a multiplication of genera had not then arisen.

A little later, the classification of *Lepidoptera* was taken up in Germany by Ochsenheimer and Treitschke, in England by Stephens and Curtis, and in France by Boisduval and Duponchel.

Stephens' arrangement of the Moths is as follows, (1828-34):

Crepuscularia—

Zygænidæ.

Sphingidæ.

Sesiidæ.

Ægeriidæ.

Nocturna—

Pomeridiana—

Hepialidæ.

Notodontidæ.

Bombycidæ.

Arctiidæ.

Noctuidæ.

Scmidiurna—

Geometridæ.

Platyptericidæ.

Pyralidæ.

Vespertina—

Tortricidæ.

Yponomeutidæ.

Tineidæ.

Alucitidæ.

The classifications of Boisduval and Duponchel ran on similar lines, except that they paid more attention to larval characters; largely increased the number of families and sub-families; and transferred the *Platyptericidæ* to the Bombyces.

After the middle of the nineteenth century, however, the Linnean system, which had practically survived almost unaltered, began to be undermined. The arrangement of moths adopted by Herrich-Schäffer in his "Aussereuropäische Schmetterlinge" (1850-58), is as follows, as far as they were included in his book:—

- Castniaria.
- Sesioidea.
- Pyromorphina.
- Zygænidea.
- Cossina.
- Æceticina.
- Psychina.
- Animulina.
- Megalopygina.
- Sphingina.
- Bombycina.
- Cilicina.
- Saturniina.
- Dendrometrina }
- Phytometrina } (= Geometræ).
- Notodontina.
- Noctuina.
- Lithosina.
- Liparidina.
- Aganaidea.
- Agaristoidea.
- Syntomoidea.
- Crambina.
- Tortricina, &c.

In 1836 Boisduval published vol i. of his "*Species général des Lépidoptères*," including the "*Papilionides*" and "*Pierides*"; but no more appeared till 1852-57, when Guenée published six volumes including "*Noctuélites*" (3 vols.), "*Deltoides et Pyralites*" (1 vol.), and "*Uranides et Phalénites*" (2 vols.). Another volume, the last which has appeared of this unfinished work, and which was quite out of date even at the time of its publication, was issued by Boisduval in 1875; this related to "*Sphingides, Sesiides, et Castnides*."

Guenée sub-divided the *Noctuæ*, *Geometræ*, and *Pyrales* into families; but these have been rejected by Lederer, and by many of the German Entomologists as founded on insufficient characters, and they have substituted a nearly continuous series. This, however, was a step in the wrong direction, for these great groups absolutely need sub-division, and it would have been far better to have improved on Guenée's subdivisions as a basis, than to have rejected them altogether.

Guenée's classification in Doubleday's "*Synonymic List of British Butterflies and Moths*" (ed. ii. 1862) was *Nocturni* (*Sphingidæ*, *Sesiidæ*, *Zeuzeridæ*, *Hepialidæ*, *Cochliop[od]idæ*, *Procridæ*, *Zygænidæ*, *Nolidæ*, *Lithosiidæ*, *Euchelidæ*, *Chelonidæ*, *Liparidæ*, *Bombycidæ*); *Geometræ*; *Drepanulæ*, *Pseudo-Bombyces* (*Dicranuridæ*, *Pygæridæ*, *Notodontidæ*), *Noctuæ*, *Deltoides*, *Aventiæ*, *Pyralides*, *Crambites*, *Tortrices*, *Tineæ* (in which the *Psychidæ* are included), and *Pterophori* (*Pterophoridæ* and *Alucitidæ*). Guenée subsequently published a revised classification in 1875 in the "*Statistique Scientifique d'Eure et Loire, Lépidoptères*," of which I gave a full abstract in the "*Zoological Record*," vol. viii. pp. 142-145. Here he commences with the *Sesiidæ*, followed by the *Sphingidæ*, and indicates the places of three foreign groups, thus: *Gynautocerides* (= *Chalcosiidæ*) between the *Procridæ* and *Zygænidæ*; the *Glaucopides*, between the

Syntomidæ (which follow the Zygænidæ) and the Nolidæ; and the Sericarides (= our Bombycidæ; Guenée's Bombycidæ = Lasiocampidæ) between the Endromidæ and the Saturniidæ.

Here, perhaps, I should say a few words about the largest, and also the most used, and most abused, of the works of the late Francis Walker, in thirty-five small 8vo volumes, 1854-1866. On the title-page it is called "List of the Specimens of Lepidopterous Insects in the Collection of the British Museum;" but the volumes are headed, "Catalogue of Lepidoptera Heterocera."

This book deserves the credit of being the only complete synopsis of the *Heterocera* of the world which has been published since the time of Fabricius; and Walker, being a good bibliographer, has supplied references to nearly all the species described before the time of the appearance of his own work. Considering how incomplete were even the best English libraries in entomological literature until quite recently, the thorough manner in which this part of the work is done is worthy of all praise. But Walker appears to have had little acumen in determining species; he has often wrongly identified the species of other authors, and he constantly failed to recognise species described by himself or other authors, and described them afresh, frequently in other genera. Walker's work, however, like that of other authors, differed much at different times, and is by no means deserving of the sweeping and wholesale condemnation it has received at the hands of many whose own work is far from faultless. No great innovations of classification were proposed in this catalogue, which is now nearly out of print, as well as out of date; and, with all its admitted imperfections, it may be long before we have any work sufficiently comprehensive to fill its place.

It was divided into the following sections, separately paged:—

Parts 1-7. *Lepidoptera Heterocera.*

(The first two sections, Sphingii and Sesii, were deferred.)

Part 1. Cydemonii, Castnii, Zygænidæ.

Part 2. Lithosiidæ (including Chalcosiidæ, and several other families subsequently indicated by Walker as distinct).

Part 3. Arctiidæ.

Part 4. Liparidæ, Psychidæ.

Part 5. Notodontidæ, Limacodidæ, Drepanulidæ, Saturniidæ.

Part 6. Saturniidæ (continued), Endromidæ, Bombycidæ.

Part 7. Cossidæ, Hepialidæ.—Addenda.

Part 8. Sphingidæ. Sesii, Sphingii.

These first eight Parts are the most carefully executed, and contain the largest amount of useful original work.

Parts 9-15. Noctuidæ.

Parts 16-19. Deltoides, Pyralites.

Parts 20-26. Geometrites.

In these sections, Walker's work is based on the six volumes of Guenée's "Suites à Buffon," with the addition of numerous new genera and species.

Parts 27-30. Crambites, Tortricites, Tineites, Pterophorites.

In this portion of the work, the arrangement is changed, and it consists only of a list of described species, without references, and descriptions of new genera and species.

Parts 31-35.—Supplement.

Several later writers have treated the *Cymatophoridæ* as the last family of *Bombyces*, instead of the first of *Noctuæ*, and

have treated the *Deltoidæ* as the last family of *Noctuæ* instead of the first of *Pyrallidæ*.

In 1882 Snellen published the first volume of his "Vlinders van Nederland: *Macrolepidoptera*," and proposed the following arrangement of the *Heterocera*:—*Hepialina*, *Sesiina*, *Cossina*, *Cochliopodina*, *Psychina*, *Zygænina*, *Syntomina*, *Lithosina*, *Liparidina*, *Bombycina*, *Lasiocampina*, *Endromidina*, *Sphingina*, *Thyridina*, *Saturnina*, *Drepanulina*, *Notodontina*, *Cymatophorina*, *Noctuina*, *Brephina*, *Geometrina*, *Pyrallidina*, *Tortricina*, *Tineina*, *Pterophorina*, *Alucitina*, *Micropterygina*.

Of the arrangement of the Sphinges and Bombyces in my own "Synonymic Catalogue of Lepidoptera Heterocera," vol. i., I need not speak, as it is substantially the same as that adopted in the present work.

In the "Transactions of the Entomological Society of London" for 1893, pp. 97-119, Dr. T. A. Chapman, who has long been making careful observations on the transformations of *Lepidoptera*, published an extremely important paper, which has largely influenced the views of other Lepidopterists, especially since his conclusions were adopted and carried further by Prof. Comstock, whose work we will presently consider.

Dr. Chapman's paper was entitled, "On some neglected points in the structure of the pupæ of Heterocerous Lepidoptera, and their probable value on classification; with some associated observations on larval prolegs."

Dr. Chapman's remodelled classification is as follows (pp. 118, 119):—

LEPIDOPTERA HETEROCERA.

"A.—OBTECTÆ. Pupa smooth and rounded, extremely solid, inner dissepiments flimsy. Free segments in both sexes, fifth and sixth (abd.). Never emerges from cocoon, or progresses in any way. Dehiscence by irregular fracture.

- " 1. Macros. Larva with hooks of ventral segments on inner side only. (Exposed feeders.) *Sphinges*, *Bombyces*, *Nolidæ*, *Nycteolidæ*, *Noctuina*, *Geometræ*.
- " 2. Pyraloids. Larva with complete circle of hooks to ventral prolegs. (Concealed feeders.) *Pyrales*, *Phycidæ*, *Eudoridæ*, *Crambidæ*, *Gelechidæ*, *Plutellidæ*, *Ecophoridæ* (*Epigraphidæ*, *Alucitidæ*).
- " 3. —? Doubtful whether Pyraloids, or of separate (classificatory) value. *Hyponomeutidæ*, *Argyresthidæ*, *Coleophoridæ* (*Perittia* ?), (*Elachistidæ* ?).

" B.—INCOMPLETÆ. Pupa less solid and rounded, appendages often partially free. Free segments may extend upward to third (abdominal); seventh always free in male, fixed in female. Dehiscence accompanied by freeing of segments and appendages previously fixed. Except in 1, pupa progresses, and emerges from cocoon.

- " 1. Pupa attached by cremaster. Free segments 4, 5, 6, 7, and 4, 5, 6. *Pterophorina*.
- " 2. Pupa free to move and emerge from cocoon.
- A. Larva concealed feeder, often miner, and usually rather active when not cramped by mine.
1. Free segments 5, 6, or 5, 6, 7. *Lithocollitidæ*, *Gracilariidæ*.
2. Free segments 4, 5, 6, or 4, 5, 6, 7.
- a. TINEÆ (*Tineidæ*, *Psychidæ*, *Sesiidæ*).
- b. *Tortrices* (*Tortricina*, *Cossus*, *Exapate*, *Simaethis*) (*Castnia*).
3. Free segments 3, 4, 5, 6, or 3, 4, 5, 6, 7.
- a. ZEUZERA and HEPIALUS tend to lose third as a free segment (are gaining it as a fixed segment ?).

b. TISCHERIA.

c. ADELIDÆ. Ovipositor (of imago) formed for piercing plant-tissues.

d. NEPTICULIDÆ. Antennæ separate from head in dehiscence.

B. Larva exposed feeder. Slug-like in form and movements, head very retractile. Free segments 3, 4, 5, 6, 7, or 3, 4, 5, 6.

1. MICROPTERYGIDÆ.* Eight pairs of abdominal legs, curious appendages, moss-feeders.

2. COCHLIOPODIDÆ. Legs evanescent, but traces of extra pairs and of curious appendages. Max. palpi large in pupa, not in imago.

3. ZYGÆNIDÆ. Legs of Macro-type. Max. palpi evanescent in pupa.

“C. —? Pupa with no free segments, appendages adherent to all abdominal segments. (*Lyonetia*, *Cemiostoma*, *Bedellia*.)

“NOTE.—*Eriocephala* (*Micropteryx purpurella*, &c.) appears by imaginal characters to belong to *Adelidæ*. But the pupa is truly *Incomplete*, not semi-incomplete, as all the other *Incompleteæ* are,—that is, the appendages are all absolutely distinct and free, and all the abdominal segments are free; moreover, it possesses working jaws.”

* “I have only seen a portion of a pupa of these, and of Psychids I have had none of my own, and have not been able to examine them freely.”—T. A. C.

The observations of Dr. Chapman on the structure and metamorphoses of the *Micropterygidæ*, small moths formerly included with the *Tineæ*, prove them to be a highly aberrant group, apparently connecting the *Lepidoptera* with other insects. The *Hepialidæ* and *Micropterygidæ*, though otherwise dissimilar, agree in possessing a jugum, or membranous yoke, which takes the place of the frenulum in other moths, and connects together the fore- and hind-wings. The wings are further apart than in other moths, and the hind-wings have the nervures as numerous as those of the fore-wings, and arranged on a similar plan. Hence Comstock and Meyrick treat them as forming a distinct section, belonging to an ancestral group of insects, forming a link between the *Lepidoptera* and *Trichoptera*. In one of the three or four genera placed in this section (*Eriocephala*, Curtis) even mandibles are present. As regards the *Hepialidæ*, however, I am hardly inclined to associate them with the *Micropterygidæ* at present, as they have many characters in common with the *Zeuzeridæ*, near which they have usually been placed.

Within the last two or three years, various new systems of classification have been proposed, differing widely from any preceding ones. Thus, in the "Fauna of British India; Moths," vol. i. (1892), Sir George Hampson arranges the families as follows:—*Saturniidæ*, *Ceratocampidæ*, *Brahmæidæ*, *Bombycidæ*, *Eupterotidæ*, *Sphingidæ*, *Notodontidæ*, *Cymatophoridæ*, *Sesiidæ*, *Tinægeriidæ*, *Syntomidæ*, *Castniidæ*, *Zygænidæ*, *Psychidæ*, *Cossidæ*, *Arbelidæ*, *Hepialidæ*, *Micropterygidæ*, *Callidulidæ*, *Drepanulidæ*, *Thyrididæ*, *Limacodidæ*, *Lasiocampidæ*, *Endromidæ*, *Pterothysanidæ*, *Lymantriidæ*, *Hypsidæ*, *Arctiidæ*, *Agaristidæ*, *Noctuidæ*, *Epicopiidæ*, *Uraniidæ*, *Epiplemidæ*, *Geometridæ*, *Pyralidæ*, *Tineidæ*, *Pterophoridæ*, and *Alucitidæ*.

Of course this system has been somewhat modified in Sir

George's later works. Cf. especially an article in the "Annals and Magazine of Natural History" for October, 1894, in which he divides the *Lepidoptera* into 41 families, adopting in the main the views of Chapman and Comstock.

In 1895, Prof. Comstock, who had previously published some important observations on the classification of *Lepidoptera*, especially with reference to the *Hepialidæ* and *Micropterygidæ*, gave them fuller development and publicity in his "Manual for the Study of Insects," published at Ithaca, N.Y., in 1895. Here the classification, although the families are considerably rearranged, follows on the whole a reversed order, and terminates with the Butterflies, as was proposed by Denis and Schiffermüller as long ago as 1776. Professor Comstock attaches very great importance to the presence or absence of a jugum, which is a small lobe projecting backwards from the fore-wing near its base, and extending under the costal margin of the hind-wing, while the greater part of the inner margin of the fore-wing overlaps the hind-wing.* With this substitute for the usual frenulum is correlated a practical identity of neurulation in the fore and hind-wings. Two families only combine these characters, the *Hepialidæ* and *Micropterygidæ*, and though they are sufficiently dissimilar in many other respects, Prof. Comstock commences the *Lepidoptera* with them, as a sub-order, under the name of *Jugatæ*. These families are supposed to be two isolated groups that have alone survived from the primitive form of *Lepidoptera* which existed in earlier geological ages. It is hardly necessary to point out that this is purely assumption, or at best, more or less well-founded deduction, quite unsupported at present by any evidence derived from the fossil remains of *Lepidoptera*, which

* This inner margin does not overlap in all the *Hepialidæ*; not in *Hepialus humuli*, for example.

at present are too rare, and frequently too doubtful, to allow us to generalise upon them to any great extent.

The remaining *Lepidoptera* form Comstock's sub-order *Frenatæ*, characterised by the possession of a frenulum, or by its substitute, the projection of the humeral angle of the hind wing below the fore-wing, to hold it in position.

These are divided into—

GENERALIZED FRENATÆ. (Fam. *Megalopygidæ*, *Psychidæ*, *Cossidæ*, *Eucleidæ*, *Pyromorphidæ*.)

SPECIALIZED FRENATÆ: divided into—

MICRO-FRENATÆ. Superfamilies, *Pyralidina*, *Tortricina*, *Tincina* and Fam., *Sesiidæ*.

SPECIALIZED MACRO-FRENATÆ:—

Frenulum - Conservers (Fam., *Dioptidæ*, *Notodontidæ*, Superfam., *Geometrina*; Fam., *Auzatidæ*, *Drepanidæ*, *Cymatophoridæ*, *Noctuidæ*, *Lymantriidæ*, *Agaristidæ*, *Pericopidæ*, *Arctiidæ*, *Lithosiidæ*, *Zygænidæ*, *Thyrididæ*, *Sphingidæ*). *Frenulum-losers*, Moths (Superfam., *Saturniina*; Fam., *Lacosomidæ*, *Lasiocampidæ*); Skippers (Superfam., *Hesperiina*); Butterflies (Superfam., *Papilionina*, including Fam., *Papilionidæ*, *Pieridæ*, *Lycænidæ*, *Nymphalidæ*).

This work has exerted a profound influence on later authors who have written on the classification of *Lepidoptera*.

An important paper which preceded Comstock's book in America was Prof. Dyar's "Classification of Lepidopterous Larvæ," published in the "Annals of the New York Academy of Science," vol. viii., pp. 194-232 (May, 1894).

Mr. A. Grote, in 1895-1896, has published some important papers in the "Mittheilungen aus dem Roemer Museum, Hildesheim," in which, taking account of the work of Comstock and Dyar, he proposes the following classification of *Lepidoptera*.

Subordo FRENATÆ: Superfamilies; *Papilionides*, *Sphingides*, *Saturniides*, *Bombycides*, *Tineides*.

Subordo JUGATÆ: Superfamilies, *Hepialides* and *Micropterygides*.

Of these, it is only necessary here to say that the *Bombycides* include the bulk of the *Bombyces*, *Noctuidæ*, and *Geometræ*, of authors (inclusive of our *Cymbidæ* and *Nolidæ*), and the *Tineides* include the *Micro-Lepidoptera*, and in addition, the *Apodidæ* (*Limacodidæ*), *Thyrididæ*, *Heterogynidæ*, *Anthroceridæ*, *Sesiidæ*, *Cossidæ* and *Psychidæ*.

The next work we have to notice is Mr. Meyrick's "Hand-book of British *Lepidoptera*." His classification is chiefly based on neururation; but whatever may prove to be its intrinsic value, it cannot be described as otherwise than revolutionary.

It would occupy far more space than we can spare to set it out fully in detail, but nine principal groups are admitted, as follows:—*Caradrinina*, *Notodontina*, *Lasiocampina*, *Papilionina*, *Pyralidina*, *Psychina*, *Tortricina*, *Tineina*, *Micropterygina*.

No other author, except Zebrowski, who published a synopsis of the *Lepidoptera* of Cracow (in Polish) in 1860, has ventured to propose to place the Butterflies in the middle of the Moths; but on this subject, Mr. Meyrick observes. "From their bright colours and diurnal habits, these insects are favourites with beginners, and are popularly regarded as forming, under the name of 'Butterflies,' a group of equal systematic value to the whole of the other *Lepidoptera*, which are termed 'Moths;' but there is no scientific justification for such a division. . . . Type of markings as in the *Notodontina* [in which Mr. Meyrick includes the *Saturniidæ*, *Geometridæ*, *Sphingidæ*, &c.], but the lines are so often converted into bands or rows of spots, or largely obsolete, that in practice no definite type is generally recognisable. . . . The group as a whole, certainly stands rather conspicuously

isolated at the present day, but there is little doubt that its origin must be traced to the *Thyrididæ*, a family of the *Pyralidina*, not represented in Britain, and hardly in Europe."

The last English book in which a revised classification of Moths is proposed, is Mr. J. W. Tutt's "British Moths" (1896). Rejecting the old-fashioned, and no longer applicable terms "*Macro-Lepidoptera*," and "*Micro-Lepidoptera*," he calls the more highly specialised families "*Obtectæ*," and those less highly specialised "*Incompletæ*," as proposed by Dr. Chapman. He includes the following families:—

OBTECTÆ.—*Sphingides*, *Saturniides*, *Bombycides* [or rather *Lasiocampides*] *Cheloniides*, *Drepanulides*, *Pseudo-Bombycides* [*Notodontidæ* and *Cymatophoridæ*] *Noctuides*, *Geometrides*, *Pyralides*, *Nolidæ*, *Nycteolidæ*, *Pyralides* (including *Pyralidæ*, *Phycidæ*, *Crambidæ*, *Gelechiidæ*, *Plutellidæ*, *Æcophoridæ*, *Hyponomeutidæ*, *Coleophoridæ*, &c.)

INCOMPLETÆ.—*Micropterygides*, *Adelides* (including *Adelidæ*, *Nepticulidæ*, *Lithocolletidæ*) *Pterphorides*, *Hepialides*, *Zeuzerides*, *Tortricides* (including *Cossidæ* and *Tortricidæ*), *Tineides* (including *Tineidæ*, *Psychidæ*, and *Sesiidæ*); *Cochliopodides*, *Zygænidæ*.

Lastly a group is admitted, called *Proto-Lepidoptera*, including only the family *Eriocephalidæ*, formerly included in the *Micropterygidæ*.

In 1895,* Dr. A. S. Packard, one of the most learned and industrious of living American Entomologists, published a most elaborate "Monograph of the Bombycine Moths of America, north of Mexico," part 1, *Notodontidæ* (National Academy of Sciences), in which he has included a sketch of his present views on the classification of the *Lepidoptera*.

* This work was not received in England till 1896.

As this elaborate work is not likely to fall under the notice of many of our readers, and Dr. Packard's detailed observations are too long to epitomise, we here content ourselves with copying his sketch of the supposed order of the evolution of the families of *Lepidoptera* from forms most nearly allied to the *Trichoptera*.

I have only been able to give a very brief sketch of some of the various systems of classification of *Lepidoptera* which have been proposed by various authors, without attempting to analyse their work, or to go into details. Many more might have been included, but brief and imperfect as it is, I hope it will be found useful and instructive to those who may wish to test any of the systems for themselves along the many paths of inquiry which are open. For my own part I am rather inclined to hope for a more natural arrangement of *Lepidoptera* by the gradual progress of observation of their various characters and stages, and the consequent slow re-arrangement of genera and families, than by attempts to re-arrange the whole sequence of families afresh, for this course can hardly fail to be the result of laying undue stress on certain characters to the exclusion of others equally important. This is one reason why authors who have attempted this method have arrived at such discordant results. Another is that every species has affinities not in two directions only, but in many, and consequently any attempts to arrange species in a linear series, which must be done in a book or catalogue, really conceal almost as many affinities as they emphasize. When all characters have been thoroughly studied and compared, we can, perhaps, strike a satisfactory average; but in the meantime, in so difficult a group as *Lepidoptera*, we are only justified at present in saying that many of the existing systems of classification are about as natural (or as unsatisfactory) as any of the rival systems.

THE MOTHS—LEPIDOPTERA HETEROCERA.

THE present volume contains the concluding series of those families of Moths which are usually classed as Sphinges or Bombyces, arranged according to the order adopted in the first volume of my "Synonymic Catalogue of Lepidoptera Heterocera," published in 1892.

FAMILY XXVII. SPHINGIDÆ.

Egg.—Large, smooth, oval.

Larva.—Naked and cylindrical, smooth or granulated; generally with a fleshy horn on the back of the penultimate segment.

Pupa.—Subterranean, enclosed in an earthen cell; or on the surface of the ground, among leaves; sometimes with a separate sheath for the proboscis.

Imago.—Large or moderate-sized, stout-bodied moths, averaging from two to six inches in expanse, though the extreme limits are from about one inch to eight or nine. The tropical representatives of this family rarely exceed those of temperate regions in size. Antennæ sometimes serrated, or with short blunt processes, but slightly thickened in the middle; seldom actually pectinated or ciliated; usually with a setiform hooked extremity. Fore-wings elongated, usually

at least twice as long as broad, and pointed, or with the hind margins indented ; hind-wings also long, narrow, and pointed at the tip ; the abdomen, which is generally long and tapering, more rarely short, and frequently more or less tufted, extends for the greater part of its length beyond the hind-wings.

The Hawk-moths are an exceedingly well-defined group, and are generally recognisable at a glance. Very few species exhibit any remarkable resemblance to other families of moths, nor are they connected with other families by any well-marked links. They have sometimes been called *Crepuscularia*, because several of the most conspicuous species fly at dusk ; but the *Macroglossinæ* are day-flyers, and some of the larger species, such as *Manduca atropos* (Linn.), fly late at night. Some species, especially *Hyloicus pinastri* (Linn.), are in the habit of resting on the trunks of trees in the daytime. The *Sphingidæ* are a rather extensive family, and although they are not very numerous in Europe, these large and conspicuous moths have always attracted a considerable amount of attention. The colours of many of the species are very beautiful, though they can rarely be called actually brilliant or gaudy. Most of them have a long proboscis, and hover over flowers, while they suck up the honey ; and some of these have a very rapid flight. In these the proboscis is often much longer than the body. Other species, in which the proboscis is short or obsolete, do not visit flowers, and their flight is usually heavy. Several of the larger Sphinges, such as the species of *Manduca* (Hübner) and the African *Basiana postica*, Walker, are known to stridulate loudly, while the larva of the Indian genus *Langia* (Moore) is said to produce a hissing sound. The *Sphingidæ* have been divided by Dr. Butler into six sub-families, of which all but one (*Ambulicinæ*) are represented in Europe, and, indeed, in Great Britain. Most of the species have a conspicuous fleshy horn

on the back of the larva towards the hinder extremity ; and in many species the larvæ are dimorphic, two constant forms, green or brown, being met with, though there is, as a rule, little or no variation in the moths themselves.

SUB-FAMILY I. MACROGLOSSINÆ.

This sub-family includes the Humming-bird Hawk-moths and Bee Hawk-moths. They are of comparatively small size, the antennæ are stout, frequently thickened from the base to the tip, which is slightly hooked, and the palpi are generally angulated externally. The fore-wings form a long triangle, much narrowed towards the base, and are usually about twice as long as broad. The hind-wings are much shorter than the fore-wings. The body is pubescent, the thorax stout, and the abdomen either tapering or obtuse, but always provided with a large expansile tuft at the extremity. The moths hover over flowers in the daytime, and rarely settle. Their flight is very rapid. The larvæ usually feed on low plants ; the head is rather small, and the anterior segments are retractile, and taper towards it ; the horn is long and curved, and the pupa is formed on the ground among leaves.

The moths belonging to this sub-family differ considerably in appearance. Some species are densely clothed with scales, while others, except along the borders, are only provided with a few loose scales on first leaving the pupa, which are quickly lost, leaving the central part of the wings quite bare. Most of the species have the hind margins of the wings entire ; but others (some of which are European, though not British) have the hind margins more or less regularly dentated and excavated.

These moths are especially interesting on account of their resemblance to humming-birds, which is heightened by the

curious expanded anal tuft. Their habits, too, are like those of humming-birds, as they poise themselves over flowers whilst imbibing the nectar through their outstretched proboscis ; and Mr. Bates, when collecting in South America, several times shot a moth by mistake for a bird. I have quoted his account further on, under the head of *Aellopus fadus*.

GENUS HEMARIS.

Sesia, pt. Fabricius, Syst. Ent., p. 547 (1775); Stephens, Ill. Brit. Ent. Haust., i., p. 134 (1828).

Hemaris, Dalman, Vet. Akad. Handl., Stockh., 1816, p. 207.

These are bee-like moths, with the body covered with long downy hair. The wings are transparent except on the dark edges, but have scattered scales on the clear portions on first emerging from the pupa. The moths fly over flowers in the day-time, in open places near woods, and appear in May and June. They are most numerous in North America, but several species are found in Europe and Asia.

THE BROAD-BORDERED BEE HAWK-MOTH. HEMARIS FUCIFORMIS.

(Plate XCVI., Fig. 1.)

Sphinx fuciformis, Linnæus, Syst. Nat. (ed. x.), i., p. 493, no. 28 (1758); id., Faun. Suec., p. 289 (1761); id., Syst. Nat., i. (2), p. 803, no. 28 (1769); Esper, Schmett., ii., p. 118, Taf. 14, figs. 2a-c (1779); Hübner, Eur. Schmett., ii., figs. 55, 117 (1803?).

Sphinx bombyliiformis, Ochsenheimer, Schmett. Eur., ii., p. 189 (1808).

Sesia bombyliiformis, Stephens, Ill. Brit. Ent. Haust., i., p. 135 (1828).

Macroglossa lonicæræ, vel *caprifolii*, Zeller, Stett. Ent. Zeit., xxx., p. 387 (1869).

Hemaris bombyliformis, Kirby, Eur. Butterflies and Moths, p. 75, pl. 20, figs. 3, a-c (1879).

Sesia fuciformis, Buckler, Larvæ of Brit. Lepid., ii., p. 121, pl. 26, figs. 3, 3a-3c (1887).

Macroglossa fuciformis, Barrett, Lepid. Brit. Isl., ii., p. 70, pl. 54, figs. 3, 3a (1893).

This moth expands about one inch and three-quarters. The wings are transparent, with a broad reddish-brown hind margin, and the base and costa are black, tinged with green. Fore-wings with a reddish-brown central streak across the end of the discoidal cell. The third and fourth abdominal segments are reddish-brown, but the fifth and sixth are more yellowish; the anal tuft is black at the sides and yellow in the middle. The larva is pale green with yellowish dorsal and lateral lines, with brownish-red spiracles, and a brownish-red or orange-coloured curved horn. It feeds on honeysuckle. The pupa is dark brown, with brownish-red incisions. In freshly emerged specimens the wings are covered with a fine reddish-grey dust.

The Broad-bordered Bee Hawk-moth is widely distributed through Europe and Asia, but appears to be commoner in the south than in the north.

Some confusion exists as to the correct names to be applied to this and the next species; but I have shown in the "Entomologist" for February, 1896 (vol. xxix., pp. 39, 40), that the broad-bordered species is the true *S. fuciformis* of Linnæus.

THE NARROW-BORDERED BEE HAWK-MOTH. HEMARIS
TITYUS.

(Plate XCVI., Fig. 2.)

Sphinx tityus, Linnæus, Syst. Nat. (ed. x.). i., p. 493, no. 24 (1758).

Sphinx fuciformis β , Linnæus, Syst. Nat. (ed. xii.), p. 494 (1767).

- Sphinx bombyliformis*, Esper, Schmett., ii, p. 180, Taf. 23, fig. 2 (1801 ?); Hübner, Eur. Schmett., ii., fig. 56 (1803 ?).
- Sphinx fuciformis*, Ochsenheimer, Schmett. Eur., ii., p. 185 (1808).
- Sesia bombyliformis*, Curtis, Brit. Ent., i., pl. 40 (1824); Buckler, Larvæ of Brit. Lepid., ii., p. 122, pl. 26, figs. 4, 4a (1887).
- Sesia fuciformis*, Stephens, Ill. Brit. Ent. Haust., i., p. 134 (1828).
- Macroglossa scabiosæ*, vel *knautii*, Zeller, Stett. Ent. Zeit., xxx., p. 387 (1869).
- Hemaris fuciformis*, Kirby, Eur. Butterflies and Moths, p. 75, pl. 20, fig. 4 (1879).
- Macroglossa bombyliformis*, Barrett, Lepid. Brit. Isl., ii., p. 73, pl. 54, figs. 3, 3a, (1893).

This species is somewhat smaller than *H. fuciformis*, expanding from an inch and a half to an inch and three-quarters. The hind margin is much narrower than in *H. fuciformis*, especially on the hind-wings, and the discoidal cell of the fore-wings has no thick dark dash at the extremity. The body is olive-green, with a black belt on the abdomen, followed by an orange-yellow one; the anal tuft is black in the middle, and yellow at the sides.

The larva is green, with a pale green line on the sides, marked with an elongated reddish-brown spot on each segment from the fifth to the twelfth. The spiracles are reddish-brown, and the horn, which is of the same colour, is straight. It feeds on field scabious (*Scabiosa arvensis*). The moth flies about flowers in the daytime, and is common in Europe and Northern Asia. Towards the southern portion of its range it is double-brooded, but in England there is only a single brood, in the spring.

GENUS CEPHIONODES.

Cephonodes, Hübner, Verz. bek. Schmett., p. 131 (1822);
Moore, Lepid. Ceylon, ii., p. 31 (1882).

This genus is the tropical representative of *Hemaris*, being found almost throughout the Ethiopian, Indo-Malayan, and Austro-Malayan regions. The body is green, and the abdomen is rather pointed at the tip, and tufted. The wings are longer and more pointed than in *Hemaris*, and transparent, except the nervures, and the borders, which are green, and often very narrow. Sometimes the abdomen is marked with a reddish belt, but is frequently uniform green.

One opaque-winged species, *C. croatica* (Esper), which inhabits South-eastern Europe, is sometimes referred to this genus, but will probably be ultimately separated under a generic name of its own. The fore-wings are green, with the hind margin broadly reddish-brown, and the hind-wings are red; the body is green, and there is a red belt followed by a yellow one on the abdomen.

CEPHIONODES HYLAS.

Sphinx hylas, Linnæus, Mant. Plant., p. 539 (1771); Donovan,
Ins. China, pl. 43, fig. 2 (1799).

Cephonodes hylas, Moore, Lepid. Ceylon, ii., p. 31, pl. 92,
figs. 4a, b (1875).

Hemaris picus, Saalmüller (nec Cramer), Lepid. Madag. i.,
p. 117, pl. 3, fig. 40 (1884).

This moth is common in the warmer parts of Asia and Africa, its range extending from China and Japan to South and West Africa. It expands upwards of two and a quarter inches. The thorax and the first and last segments of the abdomen are greenish-yellow, whilst the fourth and fifth segments, as

well as a quadrilateral spot on the sixth, are dark reddish-brown. The wings are transparent, with very narrow, blackish-brown borders, and the base of the wings is thickly covered with green scales, which extend along the basal half of the costa.

The larva, which feeds on *Gardenia*, is bluish-green, with white dorsal and sub-dorsal lines, the former bisected by a blue line ; and a long, slender, tapering horn, much thickened at the base.

This species has been confounded with *C. picus* (Cramer), a species found in India and Australia ; but *C. picus* has a narrower and paler red belt on the abdomen.

GENUS MACROGLOSSA.

Macroglossum, Scopoli, Intr. Hist. Nat. p. 414 (1776).

Macroglossa, Ochsenheimer, Schmett. Eur., iv., p. 41 (1816) ;
Stephens, Ill. Brit. Ent. Haust., i., p. 133 (1828).

The species of this genus are found throughout the greater part of the Old World, but are most numerous in the Indian Region. They may generally be recognised by their strongly-thickened antennæ, hooked at the tip, the thickly-scaled dark brown or blackish fore-wings, with darker transverse lines, the usually more or less reddish hind-wings, and the undentated hind margins. The black anal tuft, too, is very conspicuous. Nearly all the species are very similar to our well-known Humming-bird Hawk-moth in size, colour, shape, and general appearance. They are species of very rapid flight, hovering over flowers without settling, both at dusk and in the daytime, and are by no means easily captured by an inexperienced hand.

I have occasionally seen *M. stellatarum* at rest on a wall, or among roots under an overhanging bank, or in some other situation where its colour harmonised with its surroundings.

THE HUMMING-BIRD HAWK-MOTH. MACROGLOSSA
STELLATARUM.

(Plate XCVI., Fig. 3; larva, Fig. 4.)

Sphinx stellatarum, Linnæus, Syst. Nat., i., p. 495, no. 26 (1758); id. Faun. Suec., p. 288 (1761); Esper, Schmett., ii., p. 114, Taf. 13, figs. 1-3 (1779); id. Forts., p. 204, Taf. 28, fig. 3 (1782), p. 232, taf. 36, figs. 5, 6 (1783?); Hübner, Eur. Schmett., ii., figs. 57, 155 (1803?); Ochsenheimer, Schmett. Eur., ii., p. 191 (1808).

Macroglossa stellatarum, Stephens, Ill. Brit. Ent. Haust., ii., p. 133 (1828); Curtis, Brit. Ent., xvi., pl. 747 (1840); Kirby, Eur. Butterflies and Moths, p. 74, pl. 20, figs. 1, a-c (1879); Buckler, Larvæ of Brit. Lepid., ii., p. 118, pl. 26, fig. 2 (1887); Barrett, Lepid. Brit. Isl., ii., p. 66, pl. 54, figs. 1, 1a-1c (1893).

This is the type of the genus. It expands nearly two inches. The body is dark grey, lighter below, with black and white spots on the sides of the abdomen. The wings are thickly scaled, entire, the fore-wings dark greyish-brown, with black waved transverse lines, and a small black central dot; the hind-wings are rusty yellow, with the base blackish, and the hind margin dark brown. The intensity of the colour of the hind-wings is subject to variation.

The larva is green with white dots, and has a rough skin. There is a white sub-dorsal and a yellowish-white lateral line. The horn, which is short and nearly straight, is dull blue with a yellowish tip. It feeds on bedstraw (*Galium mollugo*).

"It sometimes enters the earth when about to be transformed, and at other times constructs a cover on the surface, composed of particles of earth, pieces of leaves, or portions of the stems of plants." (*Dun.an.*)

The moth is common in Europe, North Africa, and Northern and Western Asia, though more abundant in some years than in others. There is a succession of broods throughout the fine season. It appears that the moth may be conveyed from place to place by shipping, though probably not to any great distance ; for Alpheraky records that during the voyage of the Grand Duke Nicholas Mikhaïlovitch from Cadiz to Teneriffe, two specimens of *Macroglossa stellatarum* were seen flying about the deck of the steamer for the first two days of the passage. It has also been observed to fly on board ships at some distance from land.

GENUS AELLOPUS.

Aellopos, Hübner, Verz. bek. Schmett. p. 131 (1822 ?).

This is a rather small genus, allied to *Macroglossa*, which is found in South America, the West Indies, and Tropical Africa. The wings are rather longer than in *Macroglossa* ; the fore-wings are often marked with a few small transparent spots towards the tip, and there is a white or bluish-white belt on the abdomen, but no reddish or yellowish markings on the hind-wings.

The type of the genus is *A. fadus* (Cramer), which is common in South America.

AELLOPUS FADUS.

Sphinx fadus, Cramer, Pap. Exot., i., pl. 61, fig. C (1775).

Sphinx titan, Cramer, *l.c.*, ii., pl. 142, fig. F. (1777).

Macroglossa titan, Bates, Nat. Amazons, i., pp. 181-183, cum fig. (1863) ; Boisduval, Spec. Gén. Lépid. Héter. i., p. 358 (1875).

Macroglossum annulatum, Swainson, Zool. Ill., iii., pl. 132, fig. 1 (1823).

This species measures nearly two inches across the wings. The body and fore-wings are of a deep olive-green, and the hind-wings are blackish. The fore-wings have a row of small transparent spots towards the tip, and a black spot at the end of the discoidal cell, just within which a single or double whitish stripe runs to the inner margin. The hind-wings are whitish along the costa, and towards the anal angle ; and there is a conspicuous white belt towards the base of the abdomen.

The natives of South America believe that this insect turns into a humming-bird, as is mentioned by the late Mr. H. W. Bates in his "Naturalist on the River Amazons," 1st ed. (1863), vol. i. pp. 182-183, and his notes on this point are so interesting as to warrant our quoting them in full.

"Several times I shot by mistake a Humming-bird Hawk-moth instead of a bird. This moth (*Macroglossa titan*) is somewhat smaller than humming-birds generally are, but its manner of flight, and the way in which it poises itself before a flower, whilst probing it with its proboscis, is precisely like the same action in a humming-bird. It was only after many days' experience that I learnt to distinguish one from the other when on the wing. This resemblance has attracted the attention of the natives, all of whom, even educated whites, firmly believe that one is transmutable into the other. They have observed the metamorphosis of caterpillars into butterflies, and think it not at all more wonderful that a moth should change into a humming-bird. The resemblance between this hawk-moth and a humming-bird is certainly very curious, and strikes one even when both are examined in the hand. Holding them sideways, the shape of the head and position of the eyes in the moth are seen to be nearly the same as in the bird, the extended proboscis representing the long beak. At the tip of the moth's body there is a brush of long hair-scales resembling feathers, which, being expanded, looks

very much like a bird's tail. But, of course, all these points of resemblance are merely superficial. The negroes and Indians tried to convince me that the two were the same species. 'Look at their feathers,' they said; 'their eyes are the same, and so are their tails.' This belief is so deeply rooted that it was useless to reason with them on the subject. The *Macroglossa* moths are found in most countries, and have everywhere the same habits; one well-known species is found in England. Mr. Gould relates that he once had a stormy altercation with an English gentleman, who affirmed that humming-birds were found in England, for he had seen one flying in Devonshire, meaning thereby the moth *Macroglossa stellatarum*. The analogy between the two creatures has been brought about probably by the similarity of their habits, there being no indication of the one having been adapted in outward appearance with reference to the other."

GENUS PERIGONIA.

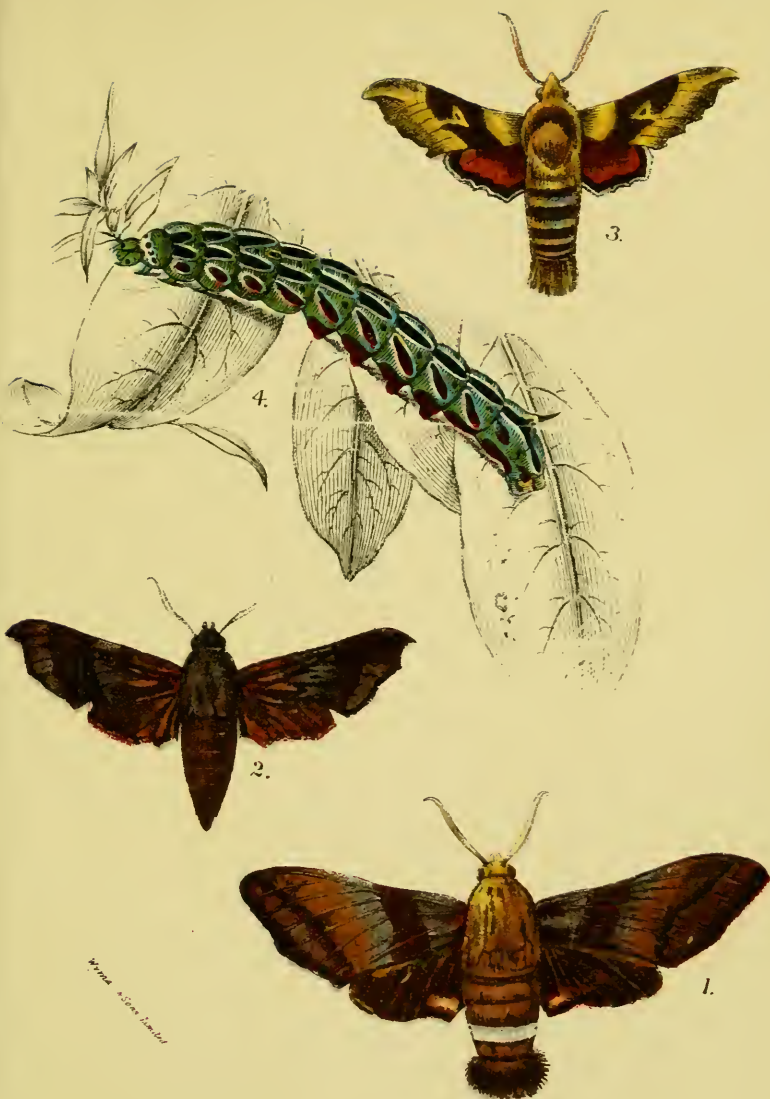
Perigonia, Herrich-Schäffer, Aussereurop. Schmett., i., p. 59 (1855); Walker, List Lepid. Ins. Brit. Mus., viii., p. 100 (1856).

This genus resembles *Macroglossa* in colouring, but the species are larger, the antennæ are more slender, and the hind margin of the fore-wings is slightly angulated in the middle and below the tip, and the hind margin of the hind-wings is slightly denticulated. The types of the genus are found in tropical America.

PERIGONIA GLAUDESCENS.

(Plate XCVII., Fig. 1.)

Perigonia glaucescens, Walker, List Lepid. Ins. Brit. Mus., viii., p. 103, no. 5 (1856).



1. *Perigonia glaucescens*.
 2. *Eulophura sardanus*.
 3. *Pterogon gauræ*.
 4. do. do, larva.

"Brown, testaceous beneath. Head with a white streak on each side behind the eye. Antennæ tawny, very slender, not longer than the thorax. Thorax slightly tinged with green. Abdomen ferruginous, slightly glaucous; fifth segment whitish; sixth and seventh segments with a whitish tuft on each side; apical tuft blackish. Wings reddish beneath. Fore-wings with a glaucous tinge, and with two oblique bands, the one dark brown and interior, the other ferruginous and exterior, and bordered with dark brown on its outer side. Hind-wings dark brown, with a luteous spot by the interior angle, and a white speck near the base of the interior border. Length of the body 12 lines; of the wings 28 lines." (*Walker.*)

This moth, which has not been figured before, is found in Haiti.

GENUS PTEROGON.

Proserpinus, Hübner, Verz. bek. Schmett., p. 132 (1822?);

Walker, List Lepid. Ins. Brit. Mus., viii., p. 97 (1856).

Pterogon, Boisduval, Ind. Meth., p. 32 (1829); id., Spec. Gén.

Lépid. Héter. i., p. 311 (1875).

This genus resembles *Macroglossa* in shape, except that the hind margins of the wings are excavated and angulated; the antennæ are strongly thickened, and the abdomen but slightly tufted.

The type is *P. proserpina* (Pallas), a European moth, which the late Mr. H. T. Stainton considered to be the most beautiful of the *Sphingidæ*. We have figured an allied North American species, and shall refer to *P. proserpina* again.

PTEROGON GAURÆ.

(Plate XCVII., Fig. 3; larva, Fig. 4.)

Sphinx gauræ, Abbot and Smith, Lepid. Georg. i., pl. 31 (1797).

Proserpinus gauræ, Clemens, Journ. Acad. Sci. Philad. iv.,
p. 134 (1859).

Pogocolon gauræ, Boisduval, Spec. Gén. Lépid. Héter. i.,
p. 315 (1875).

This moth appears to be confined to the southern States of America, principally Georgia. It is very scarce in collections. The head and thorax are greenish, with a greenish-white line on the sides of the head and thorax. The abdomen is greenish or brownish-green, with the hinder portions of the segments paler. The fore-wings are pale yellowish-green, shaded with deeper green, with a broad dark-green median band, bordered externally by pale yellowish-green, darkening towards the costa and tip, but with a pale streak at the tip. There is a small round discoidal spot of a dark-green colour. The hind-wings are orange-coloured, with a narrow terminal band and paler fringes.

The moth measures about an inch and a half across the wings.

The larva is dark green with a white band on the first segment, containing four black dots. There is a dorsal and a sub-dorsal row of black dots, between which, on each side, is situated a series of semi-elliptical black dorsal patches edged with white. On the sides is a row of somewhat oval patches, blackish and crimson behind, also edged with white. The pro-legs are crimson, and there are crimson patches on the sides of the tenth and eleventh segments. The horn is black, with the base yellow. It feeds on *Gaura biennis*.

Pterogon gauræ much resemble a species which is common in many parts of Southern and Central Europe, but is not found in England. This is *P. proserpina* (Pallas), the larva of which feeds on the evening primrose (*Oenothera*, after which it has been named by some writers), as well as on various

species of willow herb (*Epilobium*). The larva is dark bluish-grey, varied with black, with pale rosy-white belly and sides, red stigmata, and flesh-coloured pro-legs. Instead of a horn there is a shining round plate, marked with a black pupil, in a red or orange-yellow ring. It appears in July and August, and hides itself under stones during the day. The moth emerges in the June of the following year, and flies in the evening.

One or two of the smallest species of true *Sphingidæ* known have been referred to this genus, such as *P. gorgoniades* (Hübner), which has grey fore-wings, varied with brown, and brownish hind-wings, with several obscure greyish lines. It is found in South Russia, and is very rare in collections. It expands one inch and a quarter. Another brown species, found in Natal, *P. nanum* (Walker), measures scarcely an inch in expanse. Some of the larger South American species of the sub-family, *Macroglossinæ*, belonging to the genus *Calliomma* (Walker), measure two or three inches across the wings, which are brown or fawn-colour, with a silvery spot in the middle of the fore-wings.

GENUS EULOPHURA.

Eulophura, Holland, Trans. Amer. Ent. Soc., xvi., p. 58 (1889).

Head small, slightly retracted under the pro-thorax. Eyes of moderate size. Antennæ less than half the length of the fore-wings, slender, and with a very short hook at the extremity, and palpi densely clothed with silky scales, sub-conic, appressed, moderately produced. Thorax densely covered with a smooth silky vesture; patagiæ inconspicuous. Abdomen short, somewhat flattened on the ventral aspect, and in the male provided with a broad fan-shaped anal tuft. Fore-wings deeply excised on the external, and sinuate on the

internal, margins, but not toothed. Hind-wings rounded at the tip, and slightly produced near the anal angle at the extremity of the sub-median nervure ; margins entire.

Two rather inconspicuous West African species are referred to this genus.

EULOPHURA SARDANUS.

(Plate XCVII., Fig. 2.)

Enyo sardanus, Walker, List Lepid. Ins. Brit. Mus., viii., p. 116, no. 7 (1856).

Aspledon (?) *sardanus*, Boisduval, Spec. Gén. Lépid. Héter., i., p. 308 (1875).

"Blackish brown. Abdomen with three rows of indistinct luteous spots. Fore-wings slightly and partly clouded with cinereous bloom, very acute at the tips, concave from thence to a very obtuse angle, which is much in front of the middle of the exterior border ; interior angle slightly hooked. Hind-wings hardly paler than the fore-wings. Length of the body, 10 lines ; of the wings, 22 lines" (*Walker*.)

This moth was brought from Sierra Leone by the Rev. C. F. Morgan, to whom the British Museum is indebted for a very large collection of insects from that locality. It is now figured for the first time.

SUB-FAMILY II. CHÆROCAMPINÆ.

The *Chærocampinæ*, or Elephant Hawk-moths, have long narrow pointed wings, a stout thorax, and a long and frequently rather slender abdomen, with no distinct anal tuft. The fore-wings are generally brown, and often striated (sometimes they are green), and the hind-wings are usually brightly coloured, or banded with red or yellow. The palpi are generally rounded externally, the antennæ are slender, and the eyes

prominent. The proboscis is well developed. The larvæ have the fifth segment broader than the anterior segments, which are narrowed in front, and more or less retractile ; the fifth, at least, and sometimes all the segments, marked with an ocellated spot on each side ; the horn is slender, long or short, and sometimes obsolete ; the head is larger than in the *Macroglossinæ*. They feed on low plants and shrubs, such as bedstraw, spurge, willow-herb, oleander, and especially vine. The pupa is formed among leaves, on the surface of the ground.

The attenuated and retractile front segments of the larvæ give them a fancied resemblance to a hog's snout (whence the name *Chærocampa*, or Hog-caterpillar ; not *Chærocampa*, as it is frequently written), or to an elephant's trunk, whence their name of Elephant Hawk-moths. The moths fly over flowers in the evening, but their flight is less rapid than that of *Macroglossa*. They are of moderate size, measuring from two to five inches in expanse ; the majority of the species, however, expand about three inches.

GENUS CHÆROCAMPA.

- Deilephila*, pt. Ochsenheimer, Schmett. Eur. iv., p. 42 ;
Curtis, Brit. Ent. i., pl. 3 (1823).
Chærocampa, Duponchel, Lépid. France, Suppl., ii., p. 159
(1835) ; Walker, List Lepid. Ins. viii., p. 125 (1856) ;
Boisduval, Spec. Gén. Lépid. Héter., i., p. 223 (1875).
Metopsilus, pt. Duncan, Jardine's Nat. Libr. Brit. Moths,
p. 154 (1836).

In this genus the head is conical, and the body stout and rather pointed at the end. The fore-wings are moderately long, narrow at the base, and widening outwards, the costa and inner margin being nearly straight for most of their length ;

the costa is arched at its extremity, and the tip of the wing pointed; the hind margin is moderately oblique, and very slightly concave below the tip. The body and fore-wings are banded with green and rosy. The larvæ are green or brown, with a short horn.

Several closely-allied species are found in Europe and Northern and Western Asia, as far as Japan.

In my "Synonymic Catalogue of Lepidoptera Heterocera" I retained Hübner's name *Theretra* for the magazine genus *Chærocampa*. In the present work, however, I have decided to separate the species noticed under the generic names belonging to them, and am glad to be able to restore the name of *Chærocampa* to the type of that genus.

THE ELEPHANT HAWK-MOTH. CHÆROCAMPA ELPENOR.

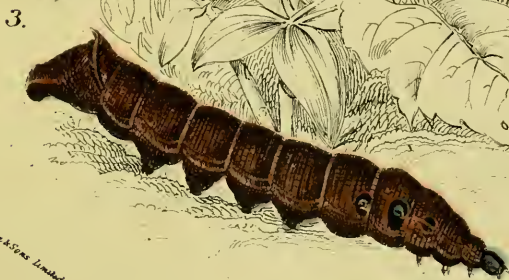
(Plate XCVIII., Fig. 1.)

Sphinx elpenor, Linnæus, Syst. Nat. (ed. x.), i., p. 491, no. 15 (1758); id., Faun. Suec. p. 288 (1761); id., Mus. Ludov. Ulricæ, p. 355 (1764); Esper, Eur. Schmett., ii., p. 91, Taf. 9 (1779), p. 200, taf. 27, fig. 3 (1782), ii. (2), p. 33, Taf. 45, fig. 1 (1801?); Hübner, Eur. Schmett. ii. fig. 61 (1803?); Ochsenheimer, Schmett. Eur. ii., p. 209 (1808).

Deilephila elpenor, Stephens, Ill. Brit. Ent. Haust., i., p. 131 (1828).

Chærocampa elpenor, Kirby, Eur. Butterflies and Moths, p. 72, pl. 16, fig. 3, a-c (1879); Buckler, Larvæ of Brit. Lepid., ii., p. 113, pl. 25, fig. 3 (1887); Barrett, Lepid. Brit. Isl., ii., p. 59, pl. 52, figs. 1, 1a-1c (1893).

This moth is widely distributed over Europe and Northern and Western Asia. It expands about two and a half inches.



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1. *Choerocampa elpenor*:
2. *Metopsilus porcellus*.

It is yellowish-green, with four rose-coloured longitudinal stripes on the thorax, and a longitudinal stripe on the abdomen; the sides and extremity of the abdomen are of the same colour. There is a black spot on each side of the second segment of the latter. The fore-wings have a rose-coloured transverse stripe running from the tip to the middle of the inner margin, and another nearer the base, running from the inner margin to the middle of the wings; there is also a broad band of the same colour on the hind margin. Hind-wings rose-coloured, with the base black. The fringes of the fore-wings are rose-coloured, and those of the hind-wings white.

The larva is dull grey, or, more rarely, green, marked with black. There is a black ocellated spot on each side of the fifth and sixth segments, the upper part of which encloses a white kidney-shaped outline, centred with brownish-grey. The horn is short, and black tipped with white. It feeds on willow-herb (*Epilobium*) bedstraw (*Galium*), fuchsia, and vine.

The moth appears in May and June. It is the commonest species of the sub-family in England.

GENUS HIPNOTION.

Hipnotion, Hübner, Verz. bek. Schmett. p. 135 (1822?);
Moore, Lepid. Ceylon, ii., p. 21 (1882).

This genus resembles the last, but the wings are longer, narrower, and more pointed, and the legs and body longer and more slender. The body and wings are adorned with silvery stripes, and the shape of the fore-wings is quite different, the hind margins being more oblique and sinuated, the hinder angle of the fore-wings projecting downwards, almost in a tooth, and the anal angle of the hind-wings being sub-lobate. The larva is provided with a very slender straight horn of moderate length.

THE VINE HAWK-MOTH. HIPBOTION CELERIO.

(Plate XCIX.)

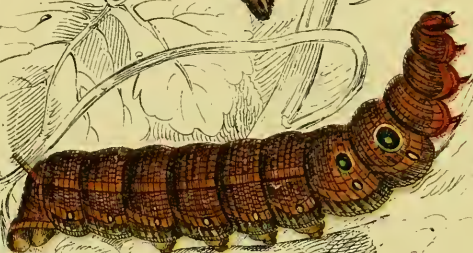
- Sphinx celerio*, Linnæus, Syst. Nat. (ed. x.), i., p. 491, no. 10 (1758); Cramer, Pap. Exot. ii., pl. 125, fig. E. (1777); Esper, Eur. Schmett. ii., p. 83, Taf. 8, figs. 1-3, p. 176, Taf. 22, fig. 1, p. 201, Taf. 28, fig. 1; ii. (2), p. 34, Taf. 45, fig. 3 (1779-1782); Hübner, Eur. Schmett. ii. figs. 59, 146 (1803?), figs. 167, 168 (1807?); Ochsenheimer, Schmett. Eur. ii., p. 205 (1808).
- Sphinx tisiphone*, Linnæus, Syst. Nat. (ed. x.), i. p. 492, no. 21 (1758); id., Mus. Ludov. Ulricæ, p. 359 (1764).
- Deilephila celerio*, Stephens, Ill. Brit. Ent. Haust. i., p. 128 (1828).
- Hippotion celerio*, Moore, Lepid. Ceylon, ii., p. 16, pl. 84, fig. 4 (1882).
- Chærocampa celerio*, Kirby, Eur. Butterflies and Moths, p. 71, pl. 16, fig. 2 (1879); Buckler, Larvæ of Brit. Lepid. ii. p. 113, pl. 25, fig. 2 (1887); Barrett, Lepid. Brit. Isl. ii., p. 51, pl. 51 (1893).

The Vine Hawk-moth is olive brown with gilded longitudinal stripes on the thorax. The abdomen has a dark brown longitudinal stripe marked with a chain of silvery spots forming a line down the centre, and double rows of short silvery streaks on the sides. The fore-wings have a shining white oblique waved stripe running from the apex almost to the base, crossed by a fine brown line, and several dark and light transverse lines towards the base. The hind-wings are rose-coloured, with two black bands connected by black nervures, and white fringes.

The larva is green or purplish-brown, with two round ocellated black spots on the fifth and sixth segments, each enclosing a yellow dot, and encircled by a ring of the same



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1. *Hippotion celerio*.
2. do. do, larva.
3. do. do, pupa.

colour ; those on the fifth segment being the larger. The horn, which is straight and slender, is brown. It feeds on vine (*Vitis vinifera*), whence its name ; as well as on yellow lady's bedstraw (*Galium verum*).

The male expands about two inches and a quarter, and the female three inches. It is widely distributed throughout the warmer parts of the Old World, but it is essentially a tropical species, which migrates northwards in Central Europe in warm summers, and it is a rare occasional visitor in England, which is almost the northern limit of its range. The same may be said of other widely-distributed Sphinges, which are occasionally taken in England, such as *Daphnis nerii*, *Dilephila livornica*, *D. euphorbiæ*, *D. galii*, and even of *Phlegethontius convolvuli* and *Manduca atropos* ; but these will be specially noted in their places. All these certainly breed here more or less regularly, but their numbers are also recruited from abroad ; and, if this were not the case, it is doubtful whether some of them would be able to perpetuate themselves as British species through the vicissitudes of a series of years.

GENUS DILONCHIE.

Deilonche, Grote, Hawk-Moths N. America, p. 30 (1886).

Head of moderate size, not tufted ; tongue as long as the body ; eyes naked ; thorax smooth ; abdomen slender, tapering ; front tibiæ unarmed ; middle tibiæ with one pair of unequal spurs ; hind tibiæ with two pairs ; wings narrow ; fore-wings somewhat sickle-shaped, with twelve nervures ; margins entire.

This genus includes several American species, with a considerable general resemblance to each other. The type is here figured.

DILONCHE TERSA.

(Plate C., Fig. 1; larva, Fig. 2.)

Sphinx tersa, Linnæus, Mant. Plant. p. 538 (1771); Drury, Ill. Exot. Ent. i., pl. 28, fig. 3 (1773); Cramer, Pap. Exot. iv., pl. 397, fig. C (1782); Abbot and Smith, Lepid. Georg. i., pl. 38 (1797).

Chærocampa tersa, Harris, Amer. Journ. Sci. xxxvi., p. 303, no. 4 (1839).

Metopsilus tersa, Duncan, in Jardine's Nat. Libr. Exot. Moths, p. 99, pl. 5, fig. 1, pl. 6, fig. 1 (1841).

This species is found throughout America as far north as the Southern United States, as well as in the West Indies, and measures about three inches across the wings. It is greyish olive-brown, with the head flesh-coloured, and a stripe of the same colour on each side of the thorax, which is clay-coloured on the back, and yellowish-brown on the sides. The fore-wings are greyish olive-brown, with several delicate parallel lines, black and whitish alternately, extending from the base somewhat obliquely to the apex. The hind-wings are black at the base, and brown along the hind margin, these two colours being separated by a row of light yellow triangular spots. The fringes are white.

The larva is delicate green, with numerous small reddish brown longitudinal spots, yellow pro-legs, and a yellow oval spot on each segment except the second and third, marked with black above and below, and placed on a lighter ground. Above these is a white stripe extending from the fifth segment to the horn, marked with a row of five red-centred ocellated spots; in a line with these, on the fourth segment, is a larger ocellated spot. The horn is red. The pupa is yellowish brown.

The larva feeds on *Spermacoce hyssopifolia* in Georgia. Those reared by Abbot spun themselves up on the 21st July, and came out in the perfect state on the 15th August; and others spun up on the 11th September, and the insects emerged on the 9th May. Abbot found the moth sucking the gourd-blossoms in autumn.

GENUS THERETRA.

Theretra, Hübner, Verz. bek. Schmett. p. 135 (1822?); Moore, Lepid. Ceylon, ii., p. 21 (1882); Kirby, Syn. Cat. Lepid. Heter., i., p. 649 (1892); Hampson, Faun. Brit. Ind. Moths, i., p. 99 (1892).

The type of this genus is *Theretra nessus* (Drury), a large East Indian moth, with the body very stout, as well as long and tapering; the fore-wings are very long, and slightly hooked at the tip, and the insect shows some resemblance to the American genera *Philampelus* and *Dupo* in form and colouring.

“Differs from *Chærocampa* in having the basal joints of the palpi hollowed out, with an orifice towards the exterior, beset with (? sensory) setæ.” (*Hampson.*)

THERETRA NESSUS.

Sphinx nessus, Drury, Ill. Exot. Ent. ii., pl. 27, fig. 1 (1773); Cramer, Pap. Exot. iii., pl. 226, fig. 1 (1779).

Sphinx equestris, Fabricius, Ent. Syst. iii. 1, p. 365, no. 29 (1793).

Theretra nessus, Moore, Lepid. Ceylon, ii., p. 22, pl. 86, fig. 1 (1882); Hampson, Faun. Brit. Ind. Moths, i., p. 99, fig. 56 (1892).

This large Hawk-moth is a native of India, China, and the Malay peninsula and islands. It expands about five inches.

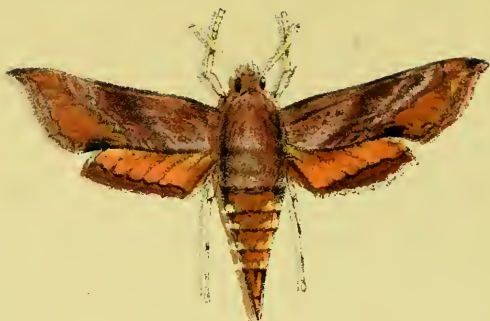
The head and thorax are olive-green, the latter with an ashy-grey streak on the sides. The abdomen is olive-green above, and golden yellow on the sides. The fore-wings are olive-brown, with the basal area olive-green, and the tip pale. There are several parallel dark lines running obliquely from the inner margin towards the tip; the innermost being angulated upwards to the costa, and beyond these is a fine waved sub-marginal line. In the discoidal cell is a black lunule, and near the hinder angle a black streak. The hind-wings are dark brown, with a broad ochreous band running from the anal angle, parallel to the hind margin.

The larva, which feeds on yam, is bluish green, with a black and green ocellated spot on the fourth segment, a sub-dorsal line, and a yellow horn.

GENUS MIAVIA.

Body moderately long and broad; abdomen with more or less metallic scaling. Fore-wings with the costa nearly straight, the tip pointed, and the hind margin oblique, with a projection in the middle. Hind-wings slightly sinuated.

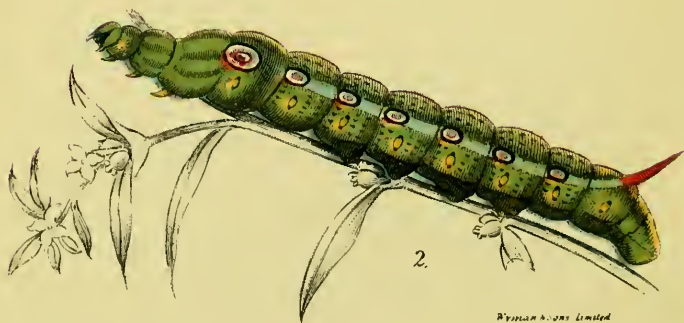
This genus only includes two or three species found in Australia and Amboina. In appearance the moths resemble *Isoples* (Hübner), being rather small Sphinges, with brown fore-wings and red hind-wings; but *Isoples* has a longer and narrower abdomen, and the fore-wings are sub-triangular, narrow at the base, and widening towards the extremity, and distinctly marked with oblique lines; and there is no distinct projection on the hind margin. Several closely-allied species are found in Asia and Africa. The type of *Isoples* is *I. thyelia* (Linn.).



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1. *Dilonche tersa*.
2. do. do, larva.
3. *Miavia johanna*.

MIAVIA JOHANNA.

(Plate C., Fig. 3.)

Therebra johanna, Kirby, Trans. Ent. Soc. London, 1877, p. 241; Waterhouse, Aid Ident. Ins. i., pl. 38 (1881).

This handsome species comes from Brisbane, and expands two inches and a quarter.

Fore-wings purplish-brown, with a broad darker central stripe bifurcated on the costa. A broad sub-marginal band of the same colour, the lower part interrupted by a large pinkish spot. Towards the base are some short dusky markings. Hind-wings red, with brown hind margins. Under side yellowish-red, the hind margins dusky, and a dusky stripe across the hind-wings, and three dusky marks on the outer half of the costa. Thorax and abdomen rosy-grey, the sides of the latter with four red belts, broadly interrupted in the middle above; and with a patch of silvery scales, mixed with reddish ones, on each side, giving the appearance of four elongated silvery spots on each side of the hinder part of the abdomen.

GENUS METOPSILUS.

Metopsilus, Duncan, in Jardine's Nat. Libr. Brit. Moths, p. 154 (1836); Kirby, Syn. Cat. Lepid. Heter. i., p. 660 (1892).

Pergesa, Walker, List Lepid. Ins. Brit. Mus. viii. p. 149 (1856); Moore, Lepid. Ceylon, ii., p. 22 (1882).

The body in this genus is moderately stout, and rather short. The antennæ are slender, filiform, and slightly longer than the thorax. Wings rather long, moderately broad, very slightly waved on the hind margin. Fore-wings not very acute, with the hind margin rather oblique, and the upper part very slightly concave. The hind-wings are rounded at the tips.

The larva is without the usual horn on the back, which is so conspicuous in most of the larvæ of the *Sphingidæ*.

THE SMALL ELEPHANT HAWK-MOTH. *METOPSILUS PORCELLUS*.

(Plate XCVIII., Fig. 2; larva, Fig. 3.)

Sphinx porcellus, Linnæus, Syst. Nat. (ed. x.), i. p. 492, no. 16 (1758); id. Faun. Suec. p. 288 (1761); Esper, Schmett. ii., p. 97, Taf. 10, figs. 1-3 (1779?); Hübner, Eur. Schmett. ii. fig. 60 (1797?); Ochsenheimer, Schmett. Eur. ii., p. 211 (1808).

Sphinx bombyliformis, Linnæus, Syst. Nat. (ed. x.), i., p. 493, no. 27 (1758).

Deilephila porcellus, Stephens, Ill. Brit. Ent. Haust. i., p. 131 (1828).

Chærocampa porcellus, Kirby, Eur. Butterflies and Moths, p. 72, pl. 16, figs. 4 a, b (1879); Buckler, Larvæ of Brit. Lepid., ii., p. 116, pl. 26, figs. 1, 1a-c (1887); Barrett, Lepid. Brit. Isl., ii. p. 55, pl. 52, figs. 2, 2 a (1893).

This is the smallest British species of the *Chærocampinæ*, the expansion of the wings being usually about one inch and three-quarters.

It is dull greenish-yellow, with broad rose-coloured hind margins, and a rose-coloured body. The fore-wings have a broad rose-coloured transverse band in front of the middle, and three spots of the same colour on the costa, extending to the apex. The fringes also are rosy. The hind-wings are blackish towards the base and costa, with white fringes and rosy nervures.

The larva is light brown mottled with darker, more rarely green, with an ocellated spot on each side of the fifth and sixth segments, and a few black dots on the fourth segment, indicating a similar spot. It feeds on bedstraw (*Galium verum*).

It is a common moth in most parts of Europe and Northern and Western Asia, and may be taken hovering over honey-suckle and other flowers at dusk in early summer.

GENUS DILEPHILA.

Deilephila, Ochsenheimer, Schmett. Eur. iv., p. 42 (1816);
 Stephens, Ill. Brit. Ent. Haust. i. p. 123 (1828);
 Duponchel, Lépid. France, Suppl. ii., p. 157 (1835);
 Walker, List Lepid. Ins. Brit. Mus. viii., p. 163 (1856);
 Boisduval, Spec. Gén. Lépid. Héter. i., p. 158 (1875).

Dilephila includes a number of species of moderate size, measuring three or four inches across the wings, with rather small conical heads, thick antennæ, and very stout and rather short bodies. The wings are broader and shorter than in *Cherocampa* and its allies, and the fore-wings are usually marked with a more or less irregular whitish band, running from near the base to the tip; the hind-wings are black, with a rosy band. The larvæ feed on *Euphorbia*, *Galium*, &c., and are spotted on the sides, but are seldom marked with ocellated spots, nor are the anterior segments attenuated and retractile. The pupa is formed on the surface of the ground among leaves, but is always more or less covered with soil.

This is a compact genus of moderate extent, and is represented in most parts of the world, but the species are most numerous in the Mediterranean Region. We have three species in England, but although they all breed here, it appears doubtful whether they could perpetuate themselves in England if they were not reinforced by fresh arrivals from the Continent.

THE STRIPED HAWK-MOTH. DILEPHILA LIVORNICA.

Sphinx livornica, Esper, Schmett., ii., p. 196 (1779); ii. (2), p. 41, Taf. 46, figs. 6, 7 (1789?); Hübner, Eur. Schmett. ii., figs. 65, 112 (1797-1818); Godart, Lépid. France, iii. p. 40, pl. 18, fig. 1 (1822).

Sphinx celerio, var. Esper, Schmett. ii. p. 87, Taf. 8, fig. 4 (1779).

Sphinx kachlini, Fuessly, Arch. pl. 4, figs. 1-4; pl. 33, figs. 1-5 (1781-1786).

Sphinx lineata, Rossi (nec Fabricius), Faun. Etr. ii., pp. 14, 359 (1794); Ochsenheimer, Schmett. Eur. ii., p. 214 (1808).

Deilephila lineata, Stephens, Ill. Brit. Ent. Haust., ii., p. 126, pl. 12, fig. 1 (1828); Boisduval, Spec. Gén. Lépid. Héter. i., p. 172 (1875).

Deilephila livornica, Kirby, Eur. Butterflies and Moths, p. 71 (1879); Buckler, Larvæ of Brit. Lepid. ii., p. 42, pl. 25, fig. 1 (1887); Barrett, Lepid. Brit. Isl. ii., p. 46, pl. 50 (1893).

The Striped Hawk-moth expands about three inches and three-quarters. It has an extended range, comprising the greater part of the Old World. The fore-wings are olive-brown, varied with bluish-grey, with a nearly straight yellowish band extending from the base to the apex of the wings, and sharply bounded on the outer side. The hind margin is bluish grey. The nervures are partly silvery white, and there is a greyish white spot in the centre, containing a small black dot. The hind-wings are rose-coloured, with the base and a broad sub-marginal band black. The narrow part of the wing beyond the band is reddish-grey, and the fringes white. The antennæ are dark brown, tipped with white, and the head, thorax, and abdomen are olive-brown. There are four longitudinal white stripes on the thorax. On the front of the abdomen are two black spots on the sides, alternating with two white ones, and the incisions are chequered with black and white.

There are two distinct forms of the larva. One is light green, dotted with yellow, with a rose-coloured head and dorsal line. There is a black spot on each segment, and

beneath this a rose-coloured one, edged below with white; next comes a yellow lateral line, marked with a round rose-coloured spot on each segment. The horn is rose-coloured above, and black beneath. The other form of the larva has a black head and a broad black dorsal line, which extends downwards on each segment to a round white spot edged with black, which is placed on a pale lateral line. Beneath this is another similar line, containing a rose-coloured spot on each segment. The belly and legs are black, and the horn is black above and red beneath.



The Striped Hawk-Moth (*Dilephila livornica*).

The larva feeds on bedstraw (*Galium verum*) and vine (*Vitis vinifera*). The metamorphosis is completed between leaves, which are drawn together on the ground or just below the surface. The pupa is yellowish-brown. The moth is double-brooded in the South of Europe.

This species is abundant throughout the Mediterranean Region, Southern Asia, and the whole of Africa, but migrates northwards in warm seasons as far as the British Isles, where it is always a great rarity. Rambur remarks that in South Spain the larva is almost omnivorous, and is sometimes so

abundant in the plain of Malaga that hundreds might be taken along the sides of the fields in a very short time. It sometimes flies by day; but in England it is generally found flying over flowers at dusk, like the other species of the genus.

The closely-allied American species, *D. lineata* (Fabricius), or *D. daucus* (Cramer), may be distinguished at once, by having six white longitudinal stripes on the thorax instead of four.

THE MADDER HAWK-MOTH. *DILEPHILA GALII*.

(Plate CII., Fig. 1.)

Sphinx gallii, Von Rottemburg, Naturforscher, vii. p. 107 (1775).

Sphinx galii, Denis & Schiffermüller, Syst. Verz. Schmett. Wien, p. 42, no. 2 (1776); Esper, Schmett. ii., p. 173, Taf. 21 (1779); Ochsenheimer, Schmett. Eur. ii., p. 217 (1808); Hübner, Eur. Schmett. ii., fig. 64 (1797?); Godart, Lépid. France, iii., p. 37, pl. 17, fig. 3 (1822).

Deilephila galii, Stephens, Ill. Brit. Ent. Haust. i., p. 125, pl. 12, fig. 2 (1828); Boisduval, Spec. Gén. Lépid. Héter. i. p. 169 (1875); Kirby, Eur. Butterflies and Moths, p. 70, pl. 18, figs. 2a, b (1879); Buckler, Larvæ of Brit. Lepid. ii., p. 36, pl. 24 (1887); Barrett, Lepid. Brit. Isl., ii. p. 42, pl. 49 (1893).

This moth expands from two and a half to three inches.

The fore-wings are dark olive-green, with a whitish stripe tapering obliquely from the inner margin, close to the base, to the tip. The hind-wings are pale rose-colour, with the base and a sub-marginal stripe black. The hind margin is of a pale purplish white. The antennæ are blackish, tipped with white, and the head and thorax dark olive-green, with a white

stripe on each side, which broadens towards the base of the fore-wings. The abdomen is also olive-green, with a white line down the centre, and two black spots on each side, followed by a white one below each. The other segments are also bordered behind with white on the sides.

The full-grown larva is of a lighter or darker shade of olive-green, or may be almost black, with a yellow dorsal line, and a row of large, round, pale yellow spots, bordered with black, on the sides. The horn is red, and the belly and legs reddish-yellow.

It is found from July to September on bedstraw (*Galium verum*, and *G. mollugo*), on *Rubia tinctorum*, and on fuchsias in gardens.

The pupa is reddish-brown.

This species is widely distributed in the southern part of the Palæarctic Region, but does not extend very far north. It is more frequently met with in England than others of the genus, and though the moth is rarely taken, the larvæ are sometimes found, not uncommonly on sandhills on the south coast, feeding chiefly on bedstraw. Yet it is doubtful whether it is truly indigenous in the sense of being thoroughly acclimatised, for Dr. Knaggs states that, although the pupæ can be reared by forcing, with the greatest success, yet if not forced, they almost invariably die during the winter. This appears to indicate that the larvæ found in England are the produce of the eggs of moths which have crossed the Channel, but that something in our climate is so unfavourable to them that comparatively few British-hatched specimens ever succeed in reaching the perfect state.

There is a North American species closely allied to *D. galii*, from which some authors, indeed, consider it hardly distinct. It is called *Dilephila intermedia* (Kirby) (*D. chamænerii*, Harris).

THE SPURGE HAWK-MOTH. *DILEPHILA EUPHORBIAE*.

(Plate CI.)

Sphinx euphorbiae, Linnæus, Syst. Nat. (ed. x.), i., p. 492, no. 17 (1758); id., Faun. Suec. p. 287 (1761); id., Mus. Ludov. Ulricæ, p. 356 (1764); Drury, Ill. Exot. Ent. i., pl. 29, fig. 3 (1773); Esper, Schmett. ii., p. 100, Taf. 11 (1780?); Hübner, Eur. Schmett., ii., figs. 66, 139, 140 (1797-1818); Ochsenheimer, Schmett. Eur. ii., p. 223 (1808); Godart, Lépid. France, iii. p. 33, pl. 17, fig. 2 (1822).

Deilephila euphorbiae, Curtis, Brit. Ent. i., pl. 3 (1823); Stephens, Ill. Brit. Ent. Haust. i., p. 124 (1828); Boisduval, Spec. Gén. Lépid. Héter. i., p. 162 (1875); Kirby, Eur. Butterflies and Moths, p. 70, pl. 18, figs. 1a, b (1879); Buckler, Larvæ of Brit. Lepid. ii., p. 30, pl. 23 (1887); Barrett, Lepid. Brit. Isl., ii., p. 36, pl. 48 (1893).

The Spurge Hawk-moth expands about two inches and a half.

The fore-wings are olive-green, with the base white, and marked with a black spot. The central area is traversed by a broad pale yellowish band suffused with reddish, and sometimes dusted with blackish. This band extends into the olive-green costal area, breaking it up into three spots; a large one at the base, a second, nearly round, in the middle, and a third, generally small and indistinct, and of varying form, near the apex. The hind margin is reddish-yellow or violet-red. The hind-wings are rose-coloured, with a black base, and a narrow black sub-marginal band. The fringes are white. The antennæ are white above, and brown beneath. The head and thorax are dark olive-green, with a white stripe on each side



1. *Dilephila euphorbiae*.
 2. do. do, larva.

of the thorax, which is occasionally suffused with reddish. The abdomen is of the same colour as the thorax, with three white and two black spots on each side. The last three incisions are white on the sides.

Several varieties of this species are met with, the prettiest being that in which the band on the fore-wings is rose-coloured.

The full-grown larva is greenish-black, with numerous white dots. The head and legs, as well as the dorsal line, are red, and the horn is red above, and black beneath. On the side of each segment is a large yellow spot, with a smaller, elongated one beneath it, and above the legs is a yellow line spotted with red. It changes, beneath the ground or under leaves, into a brownish-yellow pupa with dark wing-cases. It feeds on different species of spurge (*Euphorbia cyparissias* and *E. esula*), and will also eat *E. pepplus*.

Some authors have called this species the Spotted Elephant Hawk-moth, but this is an improper term, the larvæ of the genus *Dilephila* not exhibiting the peculiar form which has given the name of Elephant Hawk-moths to *Chærocampa elpenor* and its allies.

This is by far the commonest species of the genus throughout the greater part of Central Europe, and it also extends to the Mediterranean Region and to Western Asia. It is, however, very rare in England, once only having been met with in any quantity, a Mr. Raddon having found the larvæ abundantly on the sea spurge, on the extensive sandhills at Braunton Burrows, near Bideford, Devon. This was eighty years ago, and the locality has frequently been searched for the insect since without success, though the larva of *D. galii* is found there. Except by Mr. Raddon, only single specimens of the Spurge Hawk-moth have been met with in England at long intervals. A long account of the habits of the larva,

as observed by Mr. Melhuish on the coast of Brittany, may be found in Stainton's "Manual of British Butterflies and Moths," i., pp. 92-94. In Germany it often feeds on *Euphorbia* in the most exposed situations, such as by the side of footpaths, or along the edges of corn-fields. Highly conspicuous larvæ are sometimes regarded as exhibiting the phenomenon known as "warning colours." It is suggested that they act like a red flag to warn insect-eating animals that such larvæ are inedible. If so, the more exposed and conspicuous such larvæ became, the more it would be to their advantage.

Several South European and Mediterranean species of *Dilephila* feed on different kinds of *Euphorbia*, including one of the largest species of the genus, *D. nicea* (De Prunner), which is closely allied to *D. euphorbiæ*, but is almost twice the size, measuring nearly four inches in expanse.

We have figured two South European species of this interesting genus.

DILEPHILA HIPPOPHAES.

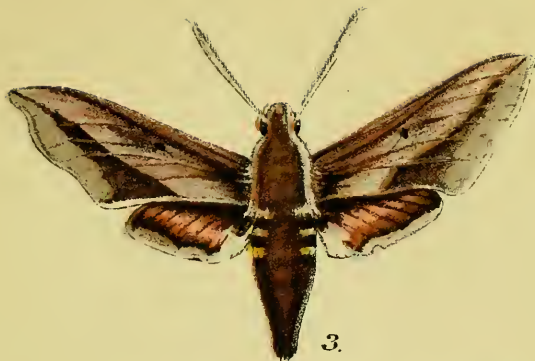
(Plate CII., Fig. 3)

Sphinx hippophaes, Esper, Schmett., ii. (2), p. 6, Taf. 38, figs. 1-3 (1789); Hübner, Eur. Schmett., ii., fig. 109 (1803?); Ochsenheimer, Schmett. Eur., ii., p. 221 (1808); Godart, Lépid. France, iii., p. 173, pl. 17 bis (1822).

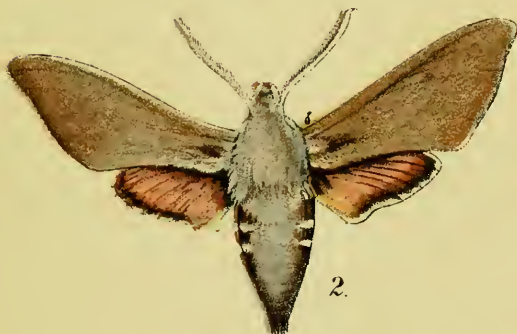
Sphinx amelia, Fonscolombe, Bull. Sci. Nat., ii., p. 162 (1827).

Deilephila æmelia, Duponchel, Lépid. France, Suppl., ii., p. 11, pl. 1, fig. 2 (1835).

Deilephila hippophaes, Boisduval, Spec. Gén. Lépid. Héter., i., p. 159 (1875); Kirby, Eur. Butterflies and Moths, p. 69 (1879).



3.



2.



1.

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- | | | |
|----|------------------|---------------------|
| 1. | <i>Dilephila</i> | <i>galii.</i> |
| 2. | " | <i>vespertilio.</i> |
| 3. | " | <i>hippophaes</i> |

This species is of about the same size as *D. galii*. The head, thorax, and abdomen are similarly coloured, but the white lateral stripes and dorsal line are wanting. The antennæ are white, and the wings narrower and more pointed. The ground colour of the fore-wings is ashy grey, speckled with blackish. The costal area is dark brown, varied with green, and shades into the light grey central area. The hind-wings are rose-coloured, with a black base, and a black sub-marginal band. The larva, which is uniform green, feeds on sea-buckthorn (*Hippophaë rhamnoides*).

Stainton called special attention to this species as one likely to occur on the south coast of England, where its food-plant is common; but this prediction has not yet been confirmed, and as the moth is a South European species, scarcely known north of Switzerland, where it is scarce and local, its presence in England does not seem probable. It is double-brooded, the moth appearing in June and September. It is said sometimes to hybridise with the next species.

DILEPHILA VESPERTILIO.

(Plate CII., Fig. 2.)

Sphinx vespertilio, Esper, Schmett., ii., p. 178, Taf. 22, fig. 4 (1779?); Fuessly, Archiv, pl. ii., figs. 1, 2 (1781); Hübner, Eur. Schmett., ii., figs. 62, 103, 104 (1797); Ochsenheimer, Schmett. Eur., ii., p. 228 (1808); Godart, Lépid. France, iii., p. 178, pl. 17, fig. 2 (1822).

Deilephila vespertilio, Boisduval, Spec. Gén. Lépid. Héter., i., p. 174 (1875); Kirby, Eur. Butterflies and Moths, p. 69 (1879).

This species expands from about two inches to two inches and a half. It is found only in the South of Europe.

The fore-wings are bluish-grey, with the base clothed with

white hair, and marked with a black spot. In the centre of the wing is a more or less distinct whitish spot, with a faint dark one beside it. A dark, tapering, and rather indistinct band, bounded by a nearly black line on the inner side, extends towards the tip. The hind-wings are black, with a rose-coloured central band, of uniform width throughout. The hind margin is very narrow, and slightly dusted with ashy grey, and the fringes are pale rose-colour. The head and body are bluish-grey above, and white below. Over the eyes is a white streak, and on the sides of the abdomen are three white spots, alternating with three black ones; the last sometimes rather indistinct.

The larva is of the same size and shape as that of *D. galii*, but has no horn. It is brownish-grey, with small blackish dots. On each segment is an almost square, reddish spot, edged with black. The belly and legs are of the same colour, and the latter are marked with a narrow light line. The spiracles are yellow, bordered with black. It feeds on *Epilobium rosmarinifolium*, and hides itself under stones during the day-time.

GENUS DUPO.

Dupo, Hübner, Verz. bek. Schmett., p. 137 (1822?).

Philampelus, pt. Harris, Amer. J. Sci., xxxvi., p. 286 (1839).

This genus and its allies include the largest and handsomest species of *Chærocampinæ*. Almost all inhabit America. The antennæ are hooked at the tips. The body is stout, long, and pointed; the fore-wings are long, pointed, and moderately broad. They measure four or five inches from tip to tip. The hind-wings are hardly acute at the tips. The larvæ mostly feed on various species of vines, whence the name *Philampelæus*. The front segments are slightly retractile,



1. *Dupo vitis*.
 2. do. do, larva.
 3. do. do, pupa.

and there are no distinct ocellated spots. The horn in *Philampelus* and its allies is well marked in the young larva, but in the full-grown larva is replaced by a shining tubercle. The pupa is rather slender, and is formed beneath the surface of the ground.

The types of the genus *Dupo* may be recognised by the pale longitudinal and oblique bands on the fore-wings, and by several of the nervures being in part conspicuously pale.

DUPO VITIS.

(Plate CIII.)

Sphinx vitis, Linnæus, Syst. Nat. (ed. x.), i., p. 491, no. 16 (1758); id., Mus. Ludov. Ulricæ, p. 354 (1764); Drury, Ill. Exot. Schmett., i., pl. 28, fig. 1 (1773); Cramer, Pap. Exot., ii., pl. 267, fig. C (1780); Rømer, Gen. Ins., pl. 20, fig. 1 (1785); Abbot & Smith, Lepid. Georg., i., pl. 40 (1797).

Sphinx fasciatus, Sulzer, Gesch. Ins., pl. 20, fig. 1 (1776).

Eumorphia elegans jussieuæ, Hübner, Samml. Exot. Schmett., i., pl. 168 (1806?).

Dupo jussieuæ, Hübner, l.c., ii., pl. 163 (1824?); Boisduval, Spec. Gén. Lépid. Héter., i., p. 202 (1875).

The fore-wings are olive-brown, with a broad flesh-coloured band running from the tip to the middle of the inner margin. Near the tip it is bifurcated, throwing a branch upwards to the costa, and below the middle it is united with another broad band running to the base, and connected about its middle with the inner margin by a short straight line. The costa and hind margin are bordered with rusty grey, and the three median nervules form conspicuous whitish lines. The inner margin is also narrowly bordered with whitish.

The hind-wings are pinkish red on the hind margin, with a broad black sub-marginal band ending in a large black mark near the anal angle. Within this is a large red patch on the inner margin, with a black mark on it. The rest of the wings are bluish-grey. The nervures are pale.

The head and thorax are dark flesh-coloured, the latter with a large olive-brown spot in the middle, and another on each side. The abdomen is also dark flesh-coloured, with two olive-brown streaks above, and narrow flesh-coloured incisions.

The larva is pale yellowish, with numerous narrow transverse black lines, and oblique white marks on the sides, directed towards the head. It feeds on vine, magnolia, and other trees. The pupa has a pointed tail.

The moth expands upwards of five inches, and is common throughout the warmer parts of North and South America. In the Southern United States it is double-brooded, the moth appearing in July and September.

In the types of *Philampelus* (Harris) the wings are broader, and less pointed than in *Dupo*, and the costa is more arched. Most of the species are green or brown, with the costal half of the hind-wings lighter green. I must notice two other very handsome species formerly placed in *Philampelus*. *Pholus achemon* (Drury), a North American species, has fawn-coloured and rather pointed fore-wings, with brown spots and lines, the most conspicuous being a large blotch towards the inner margin, and pink hind-wings, brownish towards the hind margin, and with a row of blackish spots running from the middle of the wing to the anal angle. The larva, which feeds on the grape-vine, is green when young, with a long, slender, reddish horn; and reddish-brown when full-grown, without the horn. The moth has some resemblance to the species of *Ambulyx*. One of the most beautiful of this restricted group is *Argus labruscæ* (Linn.), which is named after the wild vine,



1. *Daphnis nerii*.
2. *do. do*, larva.

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on which its large brown larva feeds. The fore-wings are green, and the hind-wings are blue, varied with red, black, and testaceous. Unfortunately the colours of this species are more liable to fade than those of any other species of *Sphingidæ* with which I am acquainted. All the species of *Philampelus* and its allies are American, except *Euchloron* (Boisduval), which includes one or two species with bright green fore-wings and black and yellow hind-wings, which inhabit Africa and Madagascar.

GENUS DAPHNIS.

Daphnis, Hübner, Verz. bek. Schmett., p. 134 (1822 ?); Curtis, Brit. Ent., xiv., pl. 626 (1837); Walker, List Lepid. Ins. Brit. Mus., viii., p. 187 (1856); Moore, Lepid. Ceylon, ii., p. 14 (1882); Hampson, Faun. Brit. India, Moths, i., p. 94 (1892).

The genus *Daphnis* represents *Philampelus* in the Old World, but the antennæ are less hooked, the wings are narrower and more pointed, and the hind tibiæ are armed with five very long spurs. The larvæ have the anterior segment retractile, are provided with a fleshy horn near the hinder extremity, and are marked with ocellated spots.

THE OLEANDER HAWK-MOTH. DAPHNIS NERII.

(Plate CIV.)

Sphinx nerii, Linnæus, Syst. Nat. (ed. x.), i., p. 490, no. 5 (1758); Cramer, Pap. Exot., iii., pl. 234, fig. D (1779); Esper, Schmett., ii., p. 43, Taf. 4, figs. 1-3 (1779 ?); p. 199, Taf. 27, figs. 1, 2 (1782 ?); Hübner, Eur. Schmett., ii., fig. 63 (1803); Ochsenheimer, Schmett. Eur., ii., p. 201 (1808); Godart, Lépid. France, iii., p. 12, pl. 13 (1822).

Daphnis nerii, Curtis, Brit. Ent., xiv., pl. 626 (1837); Moore, Lepid. Ceylon, ii., p. 14, pl. 82 (1882); Hampson, Faun. Brit. Ind., Moths, i., p. 94, fig. 54 (1892).

Chærocampa nerii, Boisduval, Spec. Gén. Lépid. Héter., i., p. 224 (1875); Kirby, Eur. Butterflies and Moths, p. 72, pl. 18, figs. 3 a-c (1879); Barrett, Lepid. Brit. Isl., ii., p. 62, pl. 53 (1893).

This large and beautiful hawk-moth expands from four to nearly four inches and a half across the wings.

The fore-wings are green, with a round whitish spot at the base, centred with dark green. Near the middle of the wing is a rosy or yellowish band, divided by a green stripe, and towards the apex is a light green transverse band, edged with white, which terminates at a large violet-grey spot, which extends from the inner angle to the middle of the wing. The hind-wings are violet-grey or blackish from the base to beyond the middle, and green on the hind margin, the two colours being separated by an undulating white line. The insect varies chiefly in the lighter or darker shade of the ground colour, and in the amount of reddish or yellowish colour in the band on the fore-wings. The antennæ are yellowish, and the head and body are green, with yellowish and white stripes and incisions.

The young larva is yellowish, with a long black horn. When full-grown it is green, or, more rarely, orange-coloured, with two large ocellated spots on the fourth segment, which are present in all stages. On the sides is a longitudinal white streak, and on the sixth and twelfth segments are numerous white dots. The horn is yellow, thick, straight, and somewhat flattened at the base, but becomes narrower and whitish towards the tip, and ends in a blackish point. The larva feeds on oleander. The pupa is brownish yellow, and is

covered with scattered black dots, except on the wing-cases. The spiracles are visible as large black spots.

The moth is very abundant throughout Africa and Southern Asia, but becomes scarcer and more local in Southern Europe, and migrates northward in Central Europe in warm summers. Single specimens have been captured in the South of England at long intervals.

SUB-FAMILY III. AMBULICINÆ.

The *Ambulicinæ* are an exclusively tropical sub-family, and barely touch the Palearctic Region, their northern limits being North India, North China, and Japan. The typical species are large moths, with long and rather narrow wings. The fore-wings are often pointed at the tips, the palpi are rounded externally, the antennæ are slender, the eyes prominent, the thorax short, and the abdomen of the male rather long, with a lateral angular expansion before the tip. In the larva the anterior segments are not retractile, but taper slightly towards the rather large head; the horn is long and oblique, and there is a row of oblique stripes on the sides.

SUB-FAMILY IV. SPHINGINÆ.

The *Sphingine* are moths with moderately long and broad fore-wings, not very pointed at the tips, and generally grey or brown. The hind-wings are varied with red, yellow, or grey, and the sides of the abdomen are marked with spots of the same colours. The head is generally rather small, but the proboscis is usually very long. In the larva, the anterior segments are not retractile, and hardly narrowed; the horn is usually long, and the sides of the body are obliquely striped.

When the proboscis is long, it is often contained in a separate sheath in the pupa. The pupa is subterranean. Most of the moths are of rather large size (the largest *Sphinxes* known belong to this sub-family), and have a strong flight. They may be captured hovering over flowers in the evening, or resting on the trunks of trees in the day-time. The larvæ frequently rest with the front segments raised, in a position which has given rise to the name *Sphinx*, now applied to the whole family. The sub-family *Sphinginae* has representatives in all parts of the world, but is most numerous in America, where the largest species are met with.

GENUS COCYTIUS.

Cocytius, Hübner, Verz. bek. Schmett., p. 140 (1822?).

Amphonyx, Poey, Cent. Lep., pl. 4 (1832); Lucas in Ramon de la Sagra, Hist. Cuba, Lépid., p. 710 (1857); Boisduval, Spec. Gén. Lépid. Héter., i., p. 62 (1875).

Ancistrognathus, Wallengren, Öfv. Vet. Akad. Förh., Stockholm, xv., p. 138 (1858).

To this genus belong about a dozen species found in South and Central America, among which are the largest *Sphingidæ* known. They have large heads, long and stout bodies, about two inches in length, and brown or greenish fore-wings, reticulated with black, and expanding from six to nine inches. The hind-wings are generally yellow at the base, and bordered with black, the two colours being separated by a hyaline band, divided into spots or streaks by the nervures. The hind margin is usually more or less undulated towards the anal angle. In some species the proboscis is of enormous length, measuring, when extended, nearly ten inches; it is used for the purpose of probing tubular flowers.



1. *Phlegethontius rusticus*.
 2. do. do, larva.

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GENUS PHLEGETHONTIUS.

Phlegethontius, Hübner, Verz. bek. Schmett., p. 140 (1822?)
Protoparce, Burmeister, Sphing. Bras., p. 6 (1856); Butler,
 Trans. Zool. Soc. Lond., ix., p. 606 (1877); Moore,
 Lepid. Ceylon, ii., p. 9 (1882).

This is a cosmopolitan genus, including species of moderate size, measuring from three to five inches across the wings. The body is long and moderately stout, with reddish or yellow spots on the abdomen; the fore-wings are brown, varied with darker or lighter markings, and the hind-wings are black or brown, generally with undulating grey or whitish markings, and are often marked with reddish or yellow at the base, according to the colour of the lateral spots on the abdomen. The proboscis is long, and in the European representative of the genus, *P. convolvuli* (Linn.), it measures four inches and a half in length. Several North American species resembling *P. convolvuli* have been taken accidentally in England, and have been included in the British lists by the older writers. One of these, *P. cingulata* (Fabricius), has the hind-wings suffused with rosy; others, such as *P. sexta* (Johanssen) (= *Sphinx carolina*, Linn.), and *P. quinque-maculatus* (Haworth), have yellow spots on the abdomen. The species of *Phlegethontius* feed on *Convolvulus*, *Solanum*, &c.; and many closely-allied yellow-spotted species are very destructive to tobacco, &c., in most parts of America.

PHLEGETHONTIUS RUSTICUS.

(Plate CV.)

Sphinx rustica, Fabricius, Syst. Ent., p. 540, no. 15 (1775);
 Sulzer, Gesch. Ins., Taf. 20, fig. 2 (1776); Cramer, Pap.
 Exot., iv., pl. 301. fig. A (1780); Boisduval, Spec. Gén.
 Lépid. Héter., i., p. 82 (1875).

Sphinx chionanthi, Abbot & Smith, Lepid. Georg., i. pl. 34 (1797); Duncan, Jardine's Nat. Libr., Exot. Moths, p. 100, pl. 5, fig. 2, pl. 6, fig. 2 (1841).

Cocytius rustica, Geyer, in Hübner's Samml. Exot. Schmett., iii., Taf. 19 (1836?).

Macrosila rustica, Walker, List Lepid. Ins. Brit. Mus., viii., p. 199, no. 2 (1856).

This species expands about four inches and a half. It is found in the Southern United States of America, and in the West Indies, as well as in South and Central America. It is of a rich brown, varied with white blotches and mottlings. The base of the fore-wings is white, and there is a white band before the middle, running from the costa to the inner margin, which is broadly white beyond. A central band connects it with another undulating white band passing from the costa to the inner margin, which it reaches beyond the middle. The brown area on the costa, bounded by these two bands, contains a small round white spot, and there is a narrow waved white streak on the brown patch near the apex of the wing. All the white portions of the wings are more or less varied with light brown in places. The hind-wings are brown, with the base and a few marks near the anal angle white. The fringes of all the wings are chequered with brown and white. The moth varies considerably in the proportion and intensity of the black, white, and brown of the wings. The head is brown and white, and the thorax is brown, marked with a large triangular patch somewhat resembling a dog's skull, and two white dots in front of it. The abdomen is brown, with three large round yellow spots on each side, and brown and white incisions.

The larva is green on the sides, merging into yellowish above, with a series of oblique stripes on the sides of the segments, consisting of white, purple, and pale blue. These



1. *Phlegethontius convolvuli*.
 2. do. do. larva.

are wanting on the three segments behind the head, which bear a double row of reddish tubercles above. The horn is yellow and granulated.

It feeds, according to Abbot, "on the fringe-tree (*Chionanthus virginica*), called old-man's-beard from its clusters of white blossoms, and also on the privet and lilac. I procured several in Virginia," he continues, "upon the last-mentioned shrub; they went into the ground July 31st, but every one of them died in the chrysalis during the winter. After I had been several years in Georgia, I found some on the old-man's-beard in June, which buried themselves on the 22nd of that month and came forth on the wing July 20th. It is not a common moth. Of those insects which go into the earth, and breed twice in the year, it is best to procure the spring caterpillars, which are much more likely to survive, the autumnal ones commonly dying in chrysalis in the winter." This remark also applies to the rearing of various European species.

THE CONVULVULUS HAWK-MOTH. PHLEGETHONTIUS
CONVOLVULI.

(Plate CVI.)

Sphinx convolvuli, Linnæus, Syst. Nat. (ed. x.), i., p. 490, no. 6 (1758); id., Mus. Ludov. Ulricæ, p. 345 (1764); Esper, Schmett., ii., p. 52, Taf. 5 (1779?); Hübner, Eur. Schmett., ii., fig. 70 (1797?); Ochsenheimer, Schmett. Eur., ii. p. 236 (1808); Godart, Lépid. France, iii., p. 26, pl. 16 (1822); Stephens, Ill. Brit. Ent. Haust., i., p. 119, (1828); Walker, List Lepid. Ins. Brit. Mus., viii., p. 212, no. 1 (1856); Boisduval, Spec. Gén. Lépid. Héter., i., p. 94 (1875); Kirby, Eur. Butterflies and Moths, p. 68, pl. 17, figs. 2 a, b (1879); Buckler, Larvæ of Brit. Lepid., ii., p. 22, 108, pl. 21, fig. 2, and pl. 22, fig. 1 (1887); Barrett, Lepid. Brit. Isl., ii., p. 22, pl. 45 (1893).

The *Convolvulus* Hawk-moth expands from about three inches and three-quarters to four inches and three-quarters. It is one of the most abundant species throughout Europe, Asia, and Africa, and a smaller form (*P. roseofasciatus*, Koch) is common in Australia and New Zealand. It is not generally common in Britain, but in certain seasons is found in comparative plenty, flying over petunias and other flowers at dusk in autumn. It is said to diffuse a slight musky odour, at least in the male.

The fore-wings are ashy grey, varied with black, dark brown, and dark grey, in large and small spots and streaks; there is also a white dot in the centre. The hind-wings are light grey, with three blackish bands, which unite on the inner margin. The second of these is forked in the middle, the first is very short, at the base, and the third or outer one is generally zig-zag. The antennæ are whitish-grey above and brownish beneath. The head and thorax are ashy grey, with black markings; and at the back of the thorax are two brownish-red marks, edged with black. The abdomen is ashy grey in the middle, but is marked on the sides alternately with black and rose-coloured spots, edged above with white.

The female is lighter coloured and less distinctly marked than the male.

The larva, which attains nearly as large a size as that of the Death's-head Hawk-moth, is lighter or darker brown or green, with a dark dorsal line. The belly and the oblique lateral stripes are ochre-yellow, and the spiracles are black, ringed with yellow. The horn is blackish. The green variety has yellowish lateral stripes, edged above with black, and a black spot on the sides of each segment below the dark green dorsal line, except at the extremities. The horn is yellow, tipped with black.

It feeds on *Convolvulus*, preferring *C. arvensis*,

The pupa is contained in an arched cell in the ground. It is shining brown, darker on the abdomen, with a separate spiral sheath for the proboscis. The moth emerges after resting for four weeks in the pupa; or not till the May or June of the following year.

GENUS SPHINX.

Sphinx, Linnæus, Syst. Nat. (ed. x.), i., p. 489 (1758); Fabricius, Syst. Ent., p. 536 (1775); Ochsenheimer, Schmett. Eur., ii., p. 183 (1808); Stephens, Ill. Brit. Ent. Haust., i., p. 118 (1828); Duponchel, Lépid. France, Suppl., ii., p. 156 (1835); Walker, List Lepid. Ins. Brit. Mus., viii., p. 211 (1854); Boisduval, Spec. Gén. Lépid. Héter., i., p. 69 (1875).

Lethia, Hübner, Verz. bek. Schmett., p. 140 (1822?).

The type of *Sphinx* is *S. ligustri*, and it was thus named, as already mentioned, from the appearance of the caterpillar when at rest. Again, the insect was called "*Papilio sphinx*" in some of the earlier writings of Linnæus, and hence *Sphinx* is one of the very few older genera of which the type was fixed from its origin without any possibility of doubt.

Sphinx includes upwards of twenty species, chiefly North American, with shorter bodies, and narrower and more pointed wings than *Phlegethontius*. The hind margins are almost entire, and the fore-wings are generally of a lighter colour, varied with grey, and without the zig-zag black markings so conspicuous in *Phlegethontius*. The hind-wings are grey or pink, with undulating black bands; and the abdomen is marked with alternate pink or grey, and black bands, instead of with lateral spots. The proboscis is shorter than in *Phlegethontius*.

THE PRIVET HAWK-MOTH. SPHINX LIGUSTRI.

(Plate CVII., Fig. 1; larva, Fig. 2.)

Sphinx ligustri, Linnæus, Syst. Nat. (ed. x.), i., p. 490, no. 7 (1758); Faun. Suec., p. 287 (1761); Mus. Ludov. Ulricæ, p. 347 (1764); Esper, Schmett., ii., p. 61, Taf. 6 (1779), p. 226, Taf. 36, fig. 7 (1783?); Hübner, Eur. Schmett., ii., fig. 69 (1803?); Ochsenheimer, Schmett. Eur., ii., p. 240 (1808); Stephens, Ill. Brit. Ent. Haust., i., p. 121 (1828); Walker, List Lepid. Ins. Brit. Mus., viii., p. 214, no. 2 (1856); Kirby, Eur. Butterflies and Moths, p. 69, pl. 17, figs. 3 a-c (1879); Buckler, Larvæ of Brit. Lepid., ii., p. 110, pl. 22, fig. 2 (1887); Barrett, Lepid. Brit. Isl., ii., p. 31, pl. 47 (1893).

This species has a wide range throughout Europe, as well as in Northern and Western Asia.

It expands from three inches and a half to four inches and a quarter.

The head is reddish-grey; the thorax dark brown, lighter in the middle, and reddish-grey on the sides; the abdomen is ringed alternately with rose-colour and blackish, with a blackish band down the centre intersecting the rings. The fore-wings are light brown, greyish towards the apex and hind margin, with several blackish lines between the nervures, and a short black central streak. The hind-wings are rose-coloured, with two black bands running parallel to the hind margin, and a third less distinct band towards the base. The moth varies occasionally in colour, and specimens with reddish-grey or almost white hind-wings are sometimes met with.

The larva is full-grown about August or September. It feeds on privet, lilac, and elder. It is more than three inches long, bright apple green, with seven oblique violet streaks on



1. *Sphinx ligustri*
2. do. do, larva.
3. *Hyloicus pinastri*.

the sides, each bounded by yellow below; orange-coloured spiracles, and a dark brown horn. The pupa, which is formed in the ground, is reddish-brown, with a rather prominent sheath for the proboscis.

The moth appears in May and June, sometimes after remaining two years in the pupa. It is one of the commonest of the larger *Sphingidæ* in England; but the colours of the larvæ are so similar to those of the food-plant, that they are difficult to detect, notwithstanding their large size and bright colour.

GENUS HYLOICUS.

Hyloicus, Hübner, Verz. bek. Schmett., p. 139 (1822?); Grote, Proc. Ent. Soc. Philad., v., p. 190 (1865).

Hyloicus includes a number of moderate-sized and rather dull-coloured Hawk-moths found in various parts of the world. The wings are shorter and less pointed than in *Sphinx*, and the fore-wings are broader towards the base. The larva is provided with a horn, but is much more slender than in *Sphinx*, and is marked with continuous longitudinal lines, instead of oblique lateral stripes.

There are several American genera allied to *Hyloicus*, including species measuring two or three inches across the wings, in which the hind-wings are red or yellow, with black or brown borders. These are *Dilephonota* (Burmeister), *Phryxus* (Hübner), *Anceryx* (Walker), &c.

THE PINE HAWK-MOTH. HYLOICUS PINASTRI.

(Plate CVII., Fig. 3.)

Sphinx pinastri, Linnæus, Syst. Nat. (ed. x.), i., p. 492, no. 20 (1758); id. Faun. Suec., p. 288 (1761); Drury, Ill. Exot. Ent., i., pl. 27, fig. 2 (1773); Esper, Schmett., ii., p. 106, Taf. 12, figs. 1-3, p. 233, Taf. 36, fig. 9 (1779-1783);

Hübner, Eur. Schmett., ii., fig. 67 (1803); Ochsenheimer, Schmett. Eur., ii., p. 243 (1808); Stephens, Ill. Brit. Ent. Haust., i., p. 121 (1828); Kirby, Eur. Butterflies and Moths, p. 68, pl. 17, figs. 1 a-b (1879); Buckler, Larvæ of Brit. Lepid., ii., p. 27, pl. 22, fig. 3 (1887); Barrett, Lepid. Brit. Isl., ii., p. 27, pl. 46 (1893).

Anceryx pinastri, Walker, List Lepid. Ins. Brit. Mus., viii., p. 223, no. 1 (1856).

Hyloicus pinastri, Kirby, Cat. Lepid. Heter., i., p. 693 (1892).

The Pine Hawk-moth expands about three inches.

The fore-wings are ashy grey, with several indistinct dark brown spots, and three short longitudinal black dashes near the middle. The hind-wings are dark brownish grey, paler towards the base, with black and white chequered fringes. The abdomen is grey above, with a black line along the middle, and is banded with white and black, or dark velvety brown, on the sides.

The larva, which feeds on pine and fir, is bright green, with a reddish-brown dorsal stripe, which expands on the segments, and narrows at the incisions, and two or three white or yellow lines on the sides. The spiracles, which are placed on a yellow line, are ringed with black. The head is orange-coloured, and the horn dark brown. It forms a dark reddish-brown pupa in the ground.

The moth appears in May or June, and is taken flying about honeysuckle and other flowers at dusk; but it is very fond of resting on the trunks of trees by day, and is more often found in this position than any other Hawk-moth. It is very rare in Britain; and on account of the unreasonable incredulity which it is too often the fashion to regard all records that have not been reconfirmed during the last few years, was actually excluded from our lists for some time, until it was



1. *Manduca atropos.*
2. do. do, larva.

rediscovered in Essex. It is now taken almost every year in the Eastern Counties. It is very abundant and destructive in the great pine-forests of Central Europe.

SUB-FAMILY V. MANDUCINÆ.

This sub-family includes only one genus, *Manduca* (Hübner), the type of which is our well-known Death's-head Hawk-moth, the largest Lepidopterous insect found in England, and with the exception of the Great Peacock-moth (*Saturnia pavonia-major*) (Linn.), the largest found in Europe. The body is very short and broad, the proboscis short, and, as well as the legs and antennæ, very thick; the proboscis terminates in a bristle. The larva has oblique stripes on the sides, and a rough recurved horn, and burrows in the ground when ready to become a pupa. The genus *Manduca* is found almost throughout Europe, Asia, and Africa, and the few species of which it consists have all a strong family likeness, and are considered by many authors to be mere varieties of *M. atropos*, with the exception of *M. lachesis* (Fabricius), a common East Indian species, which has the skull-like markings on the thorax bordered below with red, and the hind-wings heavily banded with black.

THE DEATH'S-HEAD HAWK-MOTH. MANDUCA ATROPOS.

(Plate CVIII.)

Sphinx atropos, Linnæus, Syst. Nat. (ed. x.), i., p. 490, no. 8 (1758); id., Mus. Ludov. Ulricæ, p. 348 (1764); Cramer, Pap. Exot., i., pl. 78, fig. A. (1775); Esper, Eur. Schmett., ii., p. 69, Taf. 7 (1779?); Hübner, Eur. Schmett., ii., fig. 70 (1797?); Ochsenheimer, Schmett. Eur., ii., p. 231 (1808); Godart, Lépid. France, iii., p. 60, pl. 14 (1822).

Acherontia atropos, Curtis, Brit. Ent., pl. 147 (1827); Stephens, Ill. Brit. Ent. Haust., i., p. 114 (1828); Boisduval, Spec. Gén. Lépid. Héter., i., p. 6 (1875); Kirby, Eur. Butterflies and Moths, p. 67, pl. 16, figs. 1 a-c (1879); Buckler, Larvæ of Brit. Lepid., ii., p. 107, pl. 21, fig. 1 (1887); Barrett, Lepid. Brit. Isl., ii., p. 16, pl. 44 (1893).

Manduca atropos, Kirby, Cat. Lepid. Heter., i., p. 700 (1892).

This large and interesting insect has a wide range, being found throughout Europe, as well as Western Asia and Africa. It expands from four to five inches across the fore-wings. The short, stout antennæ are white on the outer side at the tips. The head and thorax are black suffused with blue, and on the middle of the latter is a large ochreous spot, shaped something like a human skull, from which the insect derives its popular name. The abdomen, which is very thick and downy, is yellow ringed with black, and has a broad steel-blue stripe down the middle. The fore-wings are black or blue-black, dusted with white, with ochre-yellow and brownish spots and lines, and a white central spot. The hind-wings are ochre-yellow with two black bands; the outer band, which is broad, and situated close to the hind margin, expands on the nervures, sending processes to the marginal border and towards the other band, which is narrower and of uniform width throughout. On the under surface the ground colour is ochre-yellow. The proboscis is very stout and short; and Rossi determined that the sound emitted by the moth was produced by forcing air from the air-sacs through the proboscis, an explanation which has been more recently verified by Wagner.

Some variations in the intensity of colouring are met with, as well as in the distinctness of the death's-head, and the width

of the inner line of the hind-wings, which sometimes disappears entirely.

At the present time the larva usually feeds on potato, but is sometimes found on jasmine, buckthorn, and other plants. The full-grown larva is about five inches long, and will, if disturbed, retract its head, and make a scraping noise with its jaws. It is yellow, with broad oblique purple lines on the sides, which become paler on the back, where they meet in an acute angle. All the segments except the first three and the last are dotted with blue-black. The horn is yellow, set with coarse pointed elevations, and is curved downwards at the base and upwards at the tip. A green form, which is green with the anterior three segments and also the last yellow, is frequently met with; but the most remarkable, as well as the rarest, form of the larva is one in which the colour is grey or olive-brown, with numerous white spots centred with black.

The larva, when about to pass into the pupa state, burrows from about eight to ten inches below the surface, where it excavates for itself a roomy chamber. The pupa is dark reddish-brown, with black spiracles. It is often dug up in potato-fields. The moth appears in either three or four weeks, or not until the June of the next year. It is much commoner in England than it used to be.

The large size of the moth, the skull on its back, and its power of emitting a sound, have always made it an object of interest. It is said sometimes to enter hives and feast on the honey. It is seldom observed on the wing, and is believed to fly late at night; but it is an insect of powerful flight, and is sometimes captured on board ship many miles from land; though, in such cases, it may be an open question as to whether it has flown from the shore, or whether it came on board while the vessel was still at anchor, or comparatively near land.

SUB-FAMILY VI. SMERINTHINÆ.

In this sub-family the antennæ are slightly pectinated in the male, the body is stout, and the wings are shorter and less pointed than is usual in the more typical *Sphingidæ*. The wings are usually more or less dentated. The proboscis is short or obsolete, and the moths do not frequent flowers, but may be found resting on tree-trunks by day, or flying rather heavily at dusk near the trees on which their larvæ feed. The larvæ are rugose, with a straight horn; and the anterior segments are not retractile, and do not taper much towards the rather large head.

Our three British species of this sub-family are all fairly common and widely distributed throughout Europe and Northern and Western Asia, as well as in the British Islands.

The *Smerinthinæ* appear to be more variable than the other *Sphingidæ*.

GENUS LAOTHIOE.

Laothoe, pt. Fabricius in Illiger, Mag. Insekt., vi., p. 287 (1807).

Smerinthus, group 4, Walker, List Lepid. Ins. Brit. Mus., viii., p. 244 (1856).

The type of this genus is one of the largest European species of the sub-family, and differs from all the others in the proboscis being obsolete. The costa of the fore-wings is arched towards the extremity, the hind margin is oblique, and considerably dentated on the nervures; the apex of the wing is very prominent, owing to the deepest concavity being at about one-third of the length of the hind margin. The hinder angle is slightly produced into a rounded lobe, which is preceded towards the extremity of the inner margin by a

conspicuous blackish patch. The hind-wings are regularly, but less strongly, denticulated, with a large shallow concavity in the lower half of the hind margin. The antennæ of the male are slightly pectinated.

There is a considerable number of African and East Indian moths belonging to the genera *Polyptychus* (Hübner), *Marumba* (Moore), &c., which much resemble *Laothoe quercus* in appearance. They have usually a conspicuous dark mark towards the extremity of the inner margin of the hind-wings; but the wings are evenly denticulated, and want the deep concavities which are so conspicuous in *Laothoe*.

THE OAK HAWK-MOTH. LAOTHOE QUERCUS.

(Plate CLX., Fig. 1.)

Sphinx quercus, Denis & Schiffermüller, Syst. Verz. Schmett.

Wien. p. 42, no. 2; p. 244, Taf. 1 a, figs. 1 a, b; pl. 1 b, fig. 1 (1776); Esper, Schmett., ii., p. 164, Taf. 19 (1779); Forts., p. 97, Taf. 26, fig. 1 (1782); Hübner, Eur. Schmett., ii., figs. 71, 118 (1797?); Ochsenheimer, Schmett. Eur., ii., p. 255 (1808); Godart, Lépid. France, iii., p. 181, pl. 17, fig. 3 (1822).

Smerinthus quercus, Boisduval, Spec. Gén. Lépid. Héter., i., p. 18 (1875); Kirby, Eur. Butterflies and Moths, p. 73, pl. 19, fig. 2 (1879).

Laothoe quercus, Kirby, Cat. Lepid. Heter., i., p. 709 (1892).

This is a rather scarce species, found only in South-eastern Europe and Western Asia. It expands about three inches and a half.

The head, thorax, and abdomen are light ochre-yellow in the male, and darker in the female. The fore-wings, which are dentated, are pale ochreous or greyish-yellow, with several darker transverse lines, the inner side of the second

and the outer side of the third of which are suffused with brown towards the costa. The hind-wings are greyish-yellow externally, and more or less rust-coloured towards the base, with the anal angle white.

The larva feeds singly on young oaks, and is very difficult to rear. It resembles that of *Smerinthus ocellatus* and *Amorpha populi*, but has the lateral lines yellowish, and alternately broad and narrow; the last extends to the pale blue horn. The head ends above in a short bifid point, and is pale green bordered with orange; the spiracles are deep yellow. The metallic brown pupa is formed in the ground, and the moth appears in about three weeks.

GENUS DILINA.

Dilina, Dalman, Vet. Akad. Handl. Stockh. 1816, p. 212.

Mimas, Hübner, Verz. bek. Schmett., p. 142 (1822 ?); Butler, Trans. Zool. Soc. Lond., ix., p. 583 (1877).

Smerinthus, group 2, Walker, List Lepid. Ins. Brit. Mus., viii., p. 241 (1856).

In this genus the proboscis is short, but distinct, and the wings are narrower than in *Laothoe*, and not denticulated. The fore-wings have a large concavity in the middle, and a smaller one above the hinder angle, which forms a rounded projection. The hind-wings have two rounded concavities. The wings are variegated, and differ considerably both in colour and in the extent of the markings in different specimens.

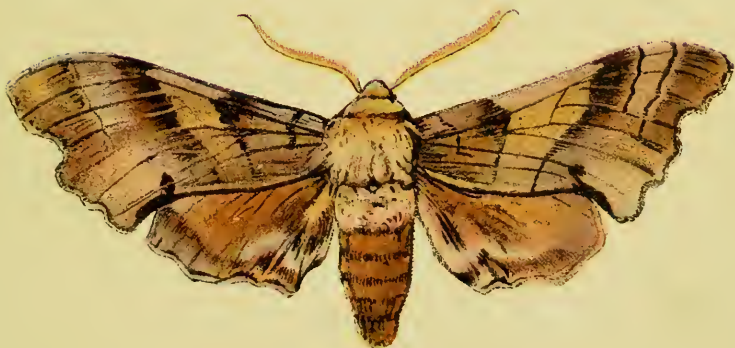
THE LINE HAWK-MOTH. DILINA TILIÆ.

(Plate CIX., Fig. 2.)

Sphinx tiliæ, Linnæus, Syst. Nat. (ed. x.), i., p. 409, no. 3 (1758); id., Faun. Succ., p. 287 (1761); id., Mus. Ludov,



2.



1.

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1. *Laothoe quercus*.
2. *Dilina tilix*.

Ulricæ, p. 343 (1764); Esper, Schmett., ii., p. 28, Taf. 3; p. 177, Taf. 22, fig. 3 (1779); id., Forts., p. 20, Taf. 41, fig. 5 (1801?); Hübner, Eur. Schmett., ii., fig. 72 (1797?); Ochsenheimer, Schmett. Eur., ii., p. 246 (1808); Godart, Lépid. France, iii., p. 64, pl. 20, fig. 1 (1822).

Smerinthus tilix, Stephens, Ill. Brit. Ent. Haust., i., p. 113 (1828); Boisduval, Spec. Gén. Lépid. Héter., i., p. 44 (1875); Kirby, Eur. Butterflies and Moths, p. 73, pl. 19, figs. 1 a-c (1879); Buckler, Larvæ of Brit. Lepid., ii., p. 105, pl. 20, fig. 3 (1887); Barrett, Lepid. Brit. Isl., ii., p. 11, pl. 43 (1893).

Dilina tilix, Kirby, Cat. Lepid. Heter., i., p. 709 (1892).

This pretty species is found throughout Europe and in Siberia. It expands two inches and a half, or three inches.

The thorax and abdomen are light green, yellowish, or ochre-brown. The fore-wings, which have the hind margins deeply excavated, vary in colour from yellowish white to reddish brown, suffused with light green or brownish-green on the hind margins, and are crossed by a band of the same colour, which is generally broken into two spots across the middle.

The hind-wings are ochre-yellow, with an indistinct blackish sub-marginal band.

The larva feeds on lime, beech, elm, birch, oak, and, it is said, sometimes on fruit-trees. It is light or dark green, shagreened, and with oblique lateral streaks, reddish above and yellow below. The horn is blue or green, and behind it is a horny red or blackish plate, surrounded by small whitish or yellow tubercles and spots. The pupa is dark brown, with blackish wing-cases. The moth appears in May or June. This is a commoner species in England than it used to be, especially in the neighbourhood of London.

GENUS AMORPHA.

Laothoe, pt. Fabricius in Illiger, Mag. Insekt., vi., p. 287 (1807); Leach, Edinb. Encycl., ix., p. 130 (1819); Grote, Bull. Buffalo Soc., i., p. 24 (1873).
Amorpha, Hübner, Tentamen, p. 1 (1810?).

The proboscis is short, and the antennæ are shortly pectinated in the male. The wings are broader than in the allied genera, and are regularly dentated. In addition to our Poplar Hawk-moth, three other species, all, I believe, poplar-feeders, are found in the Western Palæarctic Region. One of these, *A. tremulæ* (Fischer), is smaller than *A. populi*, and has no red patch at the base of the hind-wings. It is a scarce Russian species.

The other two species are much larger and paler than *A. populi* (expanding four inches and upwards); one, *A. populeti* (Bienert), is found in North Persia; and the other, *A. austauti* (Staudinger), which is a very variable insect, but usually of a pale grey colour, is found in Algeria.

THE POPLAR HAWK-MOTH. AMORPHA POPULI.

(Plate CX., Fig. 1; larva, Fig. 2.)

Sphinx populi, Linnæus, Syst. Nat. (ed. x.), i., p. 489, no. 2 (1758); id., Faun. Suec., p. 286 (1761); id., Mus. Ludov. Ulricæ, p. 342 (1764); Esper, Schmett., ii., p. 24, Taf. 2; p. 177, Taf. 22, fig. 2; p. 234, Taf. 36, fig. 10 (1779-1802); Cramer, Pap. Exot., iv., pl. 398, fig. A (1782); Hübner, Eur. Schmett., ii., fig. 74 (1797?); Ochsenheimer, Schmett. Eur., ii., p. 252 (1808); Godart, Lépid. France, iii., p. 71, pl. 20, fig. 3 (1822).

Smerinthus populi, Stephens, Ill. Brit. Ent. Haust., i., p. 112 (1828); Boisduval, Spec. Gén. Lépid. Héter., i., p. 23 (1875); Kirby, Eur. Butterflies and Moths, p. 73, pl. 19, figs. 3 a, b (1879); Buckler, Larvæ of Brit. Lepid., ii., p. 103, pl. 20, fig. 2 (1887); Barrett, Lepid. Brit. Isl., ii., p. 7, pl. 42 (1893).

The Poplar Hawk-moth inhabits the whole of Europe, as well as Northern and Western Asia. It has an expanse of about three inches across the wings. The hind margins of all the wings are regularly dentated. The ground-colour is greyish or purplish brown (occasionally inclining to rusty red in some specimens, or greyish-white in others), with darker bands and transverse lines. The fore-wings are marked with a white crescent-shaped spot near the middle. At the base of the hind-wings is a rusty red patch, and there is sometimes an indistinct whitish lunule near the middle. The body is coloured like the wings; the antennæ are reddish on the inner, and yellowish-white on the outer side.

The larva is green, with oblique yellow or white stripes on the sides, and yellow or rose-coloured stigmata centred with white. The head is bordered with yellow, and the horn is yellow, with a blue base. It feeds on poplars and willows. The dull brown pupa, which is formed in loose soil, is stout, cylindrical, and granulated. The moth is common in Britain, and flies about trees at dusk.

GENUS SMERINTHUS.

Smerinthus, Latreille, Hist. Nat. Crust. Ins., iii., p. 401 (1802); id., Consid. Générales, p. 357 (1810); Stephens, Ill. Brit. Ent. Haust., i., p. 111 (1828); Walker, List Lepid. Ins. Brit. Mus., viii., p. 239 (1856); Boisduval, Spec. Gén. Lépid. Héter., i., p. 17 (1875).

In *Smerinthus* the proboscis is very short, and the wings are moderately long and broad, and but slightly dentated; the fore-wings, however, are long and pointed, with the hind margin very oblique. The hind-wings are mostly pink, and adorned with a blue ring placed on a large black spot towards the anal angle. This mark is characteristic of three or four genera of *Smerinthinæ*, most of which are North American, though one or two are found in North Africa and Northern Asia. In one of the North American species, *Eusmerinthus geminatus* (Say), the eye-spot is double.

THE EYED HAWK-MOTH. SMERINTHUS OCELLATUS.

(Plate CX., Fig. 3.)

Sphinx ocellata, Linnæus, Syst. Nat. (ed. x.), p. 489, no. 1 (1758); id., Faun. Suec., p. 286 (1761); id., Mus. Ludov. Ulricæ, p. 341 (1764); Esper, Schmett., ii., p. 27, Taf. 1 (1779); Ochsenheimer, Schmett. Eur., ii., p. 249 (1808); Godart, Lépid. France, iii., p. 68, pl. 20, fig. 2 (1822).

Sphinx salicis, Hübner, Eur. Schmett., ii., fig. 73 (1797?).

Smerinthus ocellatus, Stephens, Ill. Brit. Ent. Haust., i., p. 112 (1828); Boisduval, Spec. Gén. Lépid. Héter., i., p. 31 (1875); Kirby, Eur. Butterflies and Moths, p. 74, pl. 19, figs. 4 a, b (1879); Buckler, Larvæ of Brit. Lepid. ii., p. 99, pl. 20, fig. 1 (1887); Barrett, Lepid. Brit. Isl., ii., p. 3, pl. 41 (1893).

The Eyed Hawk-moth is found throughout Europe, and Northern and Western Asia. The male expands about two inches and a half, and the female is often an inch larger.

The fore-wings, which are very pointed at the tips, are grey tinged with rose-colour, and variegated with brown and dusky clouds and waved streaks. The centre is marked with a pale, curved, transverse streak. The hind wings are carmine red,



1. *Amorpha populi*.
 2. do. do, larva.
 3. *Smerinthus ocellatus*

with the costa entirely grey, and the hind margin tinged with grey. Near the anal angle is the large eye-spot, centred with bluish-brown and ringed with blue, and outside this with black, from which a black dash proceeds towards the anal angle. The head and thorax are coloured like the fore-wings; the latter has a deep brown mark on the back, and the abdomen is brownish-grey.

The larva is of a fine green on the back, with the sides and belly tinged with blue. The sides are marked with a row of oblique white stripes, and the stigmata are white, surrounded with brown. The anal horn is blue. It feeds on poplar, apple, sloe, &c. The pupa is dark brown, with deep red incisions. It is not an uncommon insect in Britain, and the larvæ are often found feeding on apple-trees in orchards, though they are seldom sufficiently abundant to cause real damage.

FAMILY XXVIII. BOMBYCIDÆ.

In this family the frenulum is absent, the mouth-parts rudimentary, and the antennæ pectinated in both sexes. The wings are broad, and the body generally stout. The hind tibiæ are armed with two small spurs. The larva, which feeds on trees, is naked. It has a fleshy horn on the back, as in the *Sphingidæ*, and sometimes humps on some of the segments, and the pupa is enclosed in a cocoon.

This is a small family, but it far outweighs most of the other *Lepidoptera* in importance, for it includes the typical Chinese silkworm, that has now been naturalised in Europe for considerably over a thousand years. It is curious, however, that so few entomologists have recognised the close affinity of *Bombyx mori* to the *Sphingidæ* on the one hand, and to *Endromis versicolor* on the other. Schrank, indeed, included *B. mori* and *B. versicolor* in the same genus in 1802;

but, till latterly, his determination has been entirely overlooked. The typical silkworms, belonging to the genera *Bombyx* (Linnæus) and *Theophila* (Moore), are all East Indian, and several allied genera are found in Tropical America; but only a few African genera have been referred to the *Bombycidae*, and our only European representative is *Endromis*. The name *Bombycidae* has been erroneously applied by several entomologists to the very dissimilar family *Lasiocampidae*.

GENUS THERINIA.

Therinia, Hübner, Verz. bek. Schmett., p. 290 (1822?).

Asthenia, Westwood, Jardine's Nat. Libr., Exot. Moths, p. 209 (1841).

Asthenidia, Westwood, Trans. Zool. Soc. Lond., x., p. 515 (1879).

Body rather slender, and very short and weak, legs weak, antennæ strongly pectinated, wings very broad, moderately long, white, with brown bands. Fore-wings with the cell very short, that of the hind-wings open; hind-wings tailed; sub-costal and median nervures both three-branched; only one sub-median nervure.

The position of this genus is somewhat uncertain. It is allied to the Indian genera *Urapteroides* (Moore), and *Strophodia* (Hübner), formerly classed with the *Geometrae*, but which Sir George Hampson has recently included in the *Uraniidae*. (Cf. vol. iii., p. 43.) Both these genera, however, as well as *Urapteryx* (Leach), to which they have a superficial resemblance, have closed hind-wing cells, and almost simple antennæ. Except in the case of *Urapteryx*, which is, of course, a true *Geometra*, the transformations of all these genera of which we have been speaking are quite unknown at present.

THERINIA PODALIRIARIA.

(Plate CXI., Fig. 1.)

Asthenia podaliriaria, Westwood, Jardine's Nat. Libr., Exot. Moths, p. 209, pl. 29, fig. 1 (1841).

Asthenidia podaliriaria, Westwood, Trans. Zool. Soc. Lond. x., p. 515, pl. 76, fig. 10 (1879; neuration).

"The general ground colour of *A. podaliriaria* is very pale cream-colour, the fore-wings having three transverse narrow brown bars across them, the first before the middle, the second behind the middle (interrupted inwards towards the posterior margin), and the third close to the outer margin; the apex of the wings is marked by a large blackish patch. In the hind-wings the three bars are also continued across the surface, meeting at the anal angle; the first straight, the second angulated over the tail, and the third forming an arch over the base of the tail, which has two black spots, the outer one with an external orange stripe, the tail slender and curved. The antennæ are black. Expansion of the wings, one inch and three-quarters. This species is from Rio de Janeiro, the specimen figured being in the collection of the Rev. F. W. Hope." (*Westwood*.)

This species is the type of Westwood's genus *Asthenia* or *Asthenidia*. The type of *Therinia* is *T. lactucina* (Cramer), which is found in Surinam. It much resembles *T. podaliriaria*, but has cream-coloured wings, without the black apical patch on the fore-wings, and with three black spots towards the base of the tail on the hind-wings.

GENUS BOMBYX.

Bombyx, Linnæus, Syst. Nat. (ed. x.), i., p. 496 (1758);
Schränk, Fauna Boica, ii. (2), p. 150 (1802); Hübner,

Verz. bek. Schmett., p. 194 (1822 ?) ; Walker, List Lepid. Ins. Brit. Mus., vi., p. 1505 (1855) ; Hampson, Faun. Brit. Ind., Moths, i., p. 32 (1892).

Body stout, pubescent, a little longer than the hind-wings ; antennæ and legs short ; antennæ slightly pectinated in the male ; fore-wings with the costa arched towards the tip, which is not very acute ; hind margin slightly oblique, with a rounded concavity below the tip, and a shallower one between this and the hinder angle. Hind-wings a little shorter than the fore-wings, oval, entire, with two sub-median nervures. The larva is smooth, with a fleshy horn on the back before the extremity ; it spins an oval, closed cocoon.

The type of this genus is the Silkworm Moth, and the name *Bombyx* was applied to silkworms by the Greeks and Romans, and to the Mulberry Silkworm in particular, by mediæval writers down to the time of Linnæus. The French entomologists, however, frequently apply the name wrongly to the genus *Lasiocampa*, which belongs to a very different family, and adopt Latreille's genus *Sericaria* for the true *Bombyx* of Linnæus, although the real type of *Sericaria* is *Porthetria dispar* (Linn.)

THE MULBERRY SILKWORM. BOMBYX MORI.

Bombyx mori, Linnæus, Syst. Nat. (ed. x.), i., p. 499, no. 18 (1758) ; Esper, Schmett., iii., p. 118, Taf. 24 ; p. 396, Taf. 79, figs. 10 a, b (1782) ; Hübner, Eur. Schmett., iii., figs. 193, 271-273 (1803 ?) ; Godart, Lépid. France, iv., p. 153, pl. 14, figs. 3, 4 (1822) ; Moore, Cat. Lepid. Ins. E. Ind. House, ii., p. 374 (1859) ; Hutton, Trans. Ent. Soc. Lond. (3), ii., p. 303 (1865) ; Kirby, Eur. Butterflies and Moths, p. 133 (1880).

The Silkworm Moth measures nearly two inches in expanse, and is grey or white, with two or three dusky transverse lines, frequently obsolete. The larva varies from almost white to dark grey, with blackish lines and markings, which are usually more or less obsolete. It feeds on the white mulberry-tree, and should, especially when reared for commercial purposes, be fed on the leaves of this tree only; but it will also eat many other plants, and in England it is often reared on lettuce.

Silk was not unknown in Europe in classical times. Not only were silken fabrics of various descriptions brought from



The Mulberry Silkworm Moth (*Bombyx mori*).

the East, but a very fine silken material, derived from some native species of silkworm, possibly *Pachypasa otus* (Drury), was manufactured in the island of Cos.

The pupa of the silkworm is enclosed in an oval cocoon, closed at the ends. The inner portion is more dense than the outer, and the loose outer covering is called "floss silk." When the cocoons are to be used, they are first thrown into boiling water, which dissolves the gummy material, and the cocoon is then wound off in an apparently single thread. A machine is employed which winds off several cocoons at a time; and the thread, though very fine, is really composed of a double thread; and each thread is again made up of two others.

There are many breeds of the silkworm, some of which form

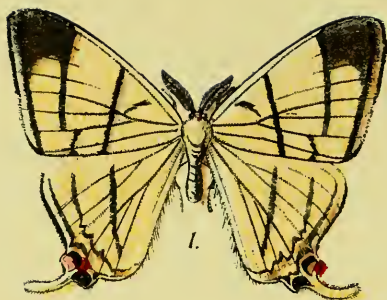
white, and others yellow, or even greenish, cocoons. The domesticated moths are almost incapable of flight, but, if reared in the open air, they recover the power of flight in a few generations.

According to the Chinese annals, Se-ling-she, the queen of the Emperor Hwang-te, was the first to rear silkworms, about 2,600 B.C. But it is more probable that she only encouraged and extended an industry which already existed among the people at that period. Subsequently the silk industry was introduced into India ; but it was not till the beginning of the sixth century A.D., during the reign of Justinian, that the eggs of the silkworm were brought to Constantinople, by two Persian monks, who concealed them in a cane. In modern times, silk-rearing has formed one of the most important industries of Southern Europe ; though it has latterly received a severe check from the ravages of various diseases, the most formidable of which might have destroyed the industry altogether but for the researches of the late M. Pasteur, who discovered means of ensuring a healthy brood by microscopical examination, and selecting for breeding purposes those insects which were found to be free from the germs of the disease. Various attempts have been made to rear silkworms in Central Europe, but the climate is not sufficiently favourable ; and I have been told that, though the quality of British-reared silk is good, the thread is too short to be of sufficient commercial value.

GENUS ENDROMIS.

Endromis, Ochsenheimer, Schmett. Eur., iii., p. 15 (1810) ;
Stephens, Ill. Brit. Ent. Haust., ii., p. 33 (1828).

The antennæ are strongly pectinated, especially in the male ; the wings are strong, entire, and considerably produced



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- 1. *Therinia podaliriaria*.
- 2.3. *Pinara cana*. ♂. ♀.
- 4. *Endromis versicolor*.

at the tip of the fore-wings, the hind margin being oblique ; the sexes are very dissimilar. The moth is thickly clothed with down, and the palpi are very short, and concealed under the long projecting hair of the head. The males fly with great rapidity in the day-time, but the females, like those of many other moths of similar habits, are very sluggish. The larva much resembles that of a *Sphinx*, and is provided with a horn on the penultimate segment.

There is but one British species, which is local rather than rare. The moth is widely distributed in Europe, and is found as far north as Lapland.

There is a large Australian moth (*Chelepteryx collesi*, Gray) which somewhat resembles *Endromis* in markings, and which some authors have supposed to be allied to it ; but the tufted larva proves it to belong to the *Lasiocampidæ*.

THE KENTISH GLORY. ENDROMIS VERSICOLOR.

(Plate CXI., Fig. 4—Female.)

Bombyx versicolora, Linnæus, Syst. Nat. (ed. x.), i., p. 499, no. 17 (1758) ; Sulzer, Gesch. Ins., Taf. 21, fig. 4 (1775) ; Esper, Schmett., iii., p. 115, Taf. 23 (1785) ; Hübner, Eur. Schmett., iii., figs. 1, 2 (1800) ; Godart, Lépid. France, iv., p. 149, pl. 14, figs. 1, 2 (1822).

Bombyx versicolor, Linnæus, Faun. Suec., p. 294 (1761).

Endromis versicolora, Ochsenheimer, Schmett. Eur., iii., p. 16 (1810) ; Stephens, Ill. Brit. Ent. Haust., ii., p. 34 (1828) ; Kirby, Eur. Butterflies and Moths, p. 125, pl. 27, figs. 1, a-c (1880) ; Buckler, Larvæ of Brit. Lepid., iii., p. 60, pl. 51, figs. 3, 3 a, b (1889) ; Barrett, Lepid. Brit. Isl., iii., p. 50, pl. 96, figs. 2, 2 a-c (1895).

The Kentish Glory is found throughout Europe and Northern Asia. The male measures about two inches and a

quarter across the wings, and the female three inches, or sometimes more.

In the male the fore-wings are rusty red, inclining to grey, with two black transverse bands, the anterior bordered on its inner side with white, and the posterior, which is angulated towards the inner margin, bordered with the same colour externally. The space between these bands is irregularly marked with white, and at the end of the discoidal cell is a black crescent-shaped mark, with its concavity directed



The Kentish Glory (*Endromis versicolor*). Male.

inwards. Near the hind margin runs an irregular row of white spots, the three upper ones being largest, and nearly subhyaline; and each nervure is marked with a white streak, which is slightly expanded at the margin. The hind-wings are tawny yellow, with a waved dusky line in the middle, and a small crescent and a few white spots posteriorly. The body and base of the wings are clothed with close long yellowish brown hair, the anterior part of the thorax being white. The antennæ and tarsi are black. The female, which is figured in the plate, is similarly marked, but is lighter in colour, with the hind-wings and abdomen almost entirely dull white.

The larva is attenuated in front, and has a pyramidal elevation on the penultimate segment in place of a hump.

Before moulting it is entirely green, but when full-grown the back is pale green, and the ventral surface minutely sprinkled with black; the sides are marked with oblique whitish or yellow streaks. It feeds on birch, beech, hazel, lime, and other forest-trees. The pupa is blackish. The male flies during the day, and with such rapidity that it is very difficult to catch.

The Kentish Glory has always been considered rather a scarce insect in Britain, but this is hardly the case, for it is widely distributed in England and Scotland, from Tilgate Forest, in Sussex, to Rannoch, in Perthshire. It is, however, local, owing to the large forests which it prefers being no longer numerous in Britain. The males, though difficult to capture on the wing, can easily be attracted, if any are near, by the presence of a female newly emerged from the pupa, which may be carried in the collector's pocket. This mode of collecting, which is called by entomologists "assembling," is equally efficacious with the Oak Eggar, and many other moths. The females may be found resting on the ends of birch twigs. The Kentish Glory is not a difficult moth to rear, if eggs or larvæ are procurable.

FAMILY XXIX. BRAHMÆIDÆ.

"Proboscis present, palpi large, rounded and upturned. Antennæ bipectinated in both sexes; mid-tibia with a single pair of spurs; hind-tibia with two spurs. Frenulum absent. Fore-wing with vein 1b forked at the base; 1c absent; 5 from near the upper angle of cell. Hind-wing with two internal veins, the cell short, with a veinlet in it; vein 5 from near the upper angle; 6 and 7 given off near the base; 8 free from the root, and nearly touching 7 beyond the cell; a pre-costal vein." (*Hampson.*)

There is but one genus in this small family at present. The typical species are Asiatic; the African species have longer and narrower wings.

GENUS BRAHMÆA.

Brahmæa, Walker, List Lepid. Ins. Brit. Mus., vi., p. 1315 (1855); Hampson, Faun. Brit. Ind. Moths, i., p. 30 (1892).

This genus includes large moths, often measuring five or six inches in expanse. They are not brightly coloured, but are of various shades of grey, brown, or black, and are marked with undulating light and dark lines towards the base of the fore-wings, and on the marginal half of all the wings. In the middle of the inner margin of the fore-wings is often a large round spot, giving the appearance of being in relief, like the "eyes" on the wings of the Argus pheasant.

BRAHMÆA LEDERERI.

(Plate CXII.)

Brahmæa ledereri, Rogenhofer, Verh. Zool. bot. Ges. Wien, xxiii., p. 574 (1873); xxv., p. 801 (1875).

This species is a large and handsome moth, which measures about four inches and a half across the rounded wings.

The fore-wings are black at the base, crossed by a zig-zag grey line, beyond which the black area is rather broad above and narrow below, and is followed by a series of alternate grey and black festooned lines, the latter most distinct outside and below. Beyond this is a sharply-defined and slightly oblique central band composed of large connected oval black spots, the seventh and tenth from the costa the largest, and each, except towards the costa, filled up with dull tawny, or grey.



Brahmæa ledereri.

Next comes a series of broad yellowish-brown festooned lines, frequently whitish on their inner side, and rather indistinctly separated by blackish lines; the sub-terminal black line is sharply zig-zag, and the marginal area is grey, shading into yellow on the fringes. The ends of the teeth of the sub-terminal line are connected by another black line, slightly curved outwards between each two; the largest space thus enclosed is that nearest the costa, and is black, bordered internally with yellowish and grey; the two next spaces are tawny and grey, and the four nervures nearest the costa are marked with several white dots on the inner side of the sub-terminal line, and with a large one just beyond. On the hind-wings the basal half is smoky brown, greyish towards the base, and blackish outwardly; the marginal half of the wing is occupied by a zig-zag series of black lines, separating spaces which are whitish basally and yellowish outwardly; the two black lines nearest the margin are the broadest, and towards the margin the hind-wings shade into yellowish-brown. The body is varied with smoky black and grey, the antennæ are tawny, and the black pro-thorax is narrowly bordered with yellowish in front, and in the middle behind.

The larva, which is found on *Phillyrea latifolia* (Linn.), in May in the Taurus Mountains of Cilicia (Asia Minor), is not unlike that of *Chærocampa elpenor*. It is pitchy-brown, with the thoracic shield shining black. The first three segments have an ochre-yellow dorsal line, and are yellow on the sides; the yellow colour continues as a lateral interrupted band to the extremity of the body, and below it is an oval ochreous-yellow spot on each segment; the spiracles are also yellowish, bordered with black. The second and third segments are rather inflated, and on each side of the dorsal line stands a smooth oval yellowish wart on these segments, preceded by a double yellow crescent, divided by the dorsal line. These

warts replace, in the full-grown larva, two light-coloured granulated spiny processes found in the earlier stages of the larva, not unlike those exhibited by the larva of *Agria tau* on the first and third segments. The pupa is blackish and cylindrical.

The nearest allied species is *B. christophi* (Staudinger), from Lenkoran, on the Caspian Sea; but the band of oval spots on the fore-wings of the latter species is much broader and paler, and more uniform both in width and colour. The other Asiatic species of *Brahmæa*, which are found in India, China, Japan, &c., though all presenting a strong generic resemblance, have patterns too dissimilar from *B. ledereri* for any of them to be mistaken for it.

FAMILY XXX. DREPANULIDÆ.

Egg.—Oval, pale, turning red as it matures.

Larva.—Naked, humped on the back, with only fourteen legs, the anal claspers being obsolete; the terminal segment is usually more or less pointed, and sometimes ends in a long projection.

Pupa—Slender, enclosed in a cocoon among leaves and moss.

Imago.—Of small or moderate size. Palpi and proboscis generally short or obsolete; antennæ pectinated in male; body rather short and slender; wings with a frenulum, short and broad, often hooked, and with one or two sub-median nervures.

The short slender bodies and broad wings of these moths give them some resemblance to *Geometræ*, with which they were classed by many of the older authors. Most of the

British species are not rare, and are easily disturbed during the daytime. They are generally white, grey, or brown, with darker transverse lines, and sometimes blotches.

This family numbers about thirty genera, and is about equally well represented in the different quarters of the globe; but none of the genera are very numerous in species. I shall notice one or two of the most interesting and representative British and foreign genera, and will then pass on to the more important families which follow. The *Drepanulidæ* are a fairly well-marked group, but are connected by various links with the *Notodontidæ*, *Bombycidæ*, *Saturniidæ*, and, perhaps, even with the *Psychidæ*.

GENUS PLATYPTERYX.

Drepana, pt. Schrank, Fauna Boica, ii. (2), p. 155 (1802);
Stephens, Ill. Brit. Ent. Haust., iv., p. 5 (1834).

Platypteryx, Laspeyres, Neue Schrift. Ges. Nat. Freunde
Berl., iv., p. 29 (1803); Hübner, Tentamen, p. 1
(1810?); Treitschke, Schmett. Eur., v. (3), p. 399 (1839).

Falcaria, pt. Haworth, Lepid. Brit., p. 152 (1809).

The type of this genus was fixed by Hübner as *P. binaria* (Hufnagel) = *P. hamula* (Esper). I have figured an allied species, *P. harpagula* (Esper). These moths are all very similar in shape, the tip of the fore-wings being more or less hooked, and the hind margin below forming a rounded curve to the inner margin, the hinder angle being entirely rounded off. The type of the genus *Falcaria* is *F. lacertinaria* (Linnæus), in which the hind margin of the fore-wings below the tip forms two or three strong teeth before the hinder angle, which is less completely rounded off than in *Platypteryx*.

THE SCARCE HOOK-TIP. *PLATYPTERYX HARPAGULA*.

Bombyx harpagula, Esper, Schmett., iii., p. 373, Taf. 73, figs. 1, 2 (1786).

Phalæna harparia, Fabricius, Ent. Syst., Suppl., p. 449 (1798).

Bombyx sicula, Hübner, Eur. Schmett., iii., fig. 41 (1800).

Platypteryx sicula, Laspeyres, Neue Schrift. Ges. Nat. Freunde Berl., iv., p. 46 (1803); Treitschke, Schmett. Eur., v. (3), p. 403 (1826); Duponchel, Lépid. France, vii., p. 92, pl. 140, fig. 6 (1829).

Drepana sicula, Kirby, Eur. Butterflies and Moths, p. 124 (1880); Buckler, Larvæ of Brit. Lepid., iii., p. 66, pl. 52, figs. 4, 4 a-c (1889); Barrett, Lepid. Brit. Isl., iii., p. 67, pl. 99, figs. 1, 1 a, b (1895).



The Scarce Hook-tip (*Platypteryx sicula*).

The Scarce Hook-tip is a native of Europe. It measures about an inch and a half across the wings.

The fore-wings are ochre-yellow, slightly dusted with red, with several indistinct darker lines, and a golden V-shaped spot in the centre, shaded with grey. Beyond this, towards the fringes, the colour becomes darker, and there is a dull yellow spot bordered with dark blue. The hind-wings are also ochre-yellow, but of a paler shade than the fore-wings, with several indistinct darker lines.

The larva feeds on oak and birch in May and June. It is reddish-brown on the sides, with lighter and darker stripes and spots, and the back is unequally suffused with yellow. The yellow portion is spotted with brownish, especially on the anterior segments. On the fourth segment is a brown fleshy prominence, which is divided into two obtuse points, and at the end of the body is a reddish-brown tail.

The pupa, which is dusted with blue, is formed in a cocoon between leaves.

A very rare moth in England, which has only been found near Bristol.

GENUS DREPANA.

Drepana, Schrank, Fauna Boica, ii. (2), p. 155 (1802).

Cilix, Leach, Edinb. Encycl., ix., p. 134 (1815); Stephens, Ill. Brit. Ent. Haust., iv., p. 8 (1834).

This genus differs from the other European genera of the family in the fore-wings being rounded, instead of being pointed or hooked at the tip. The type is a common and well-known insect in Europe and Western Asia, and is also said to occur in North America. Other species are found in India, China, and Madagascar (?).

THE CHINESE CHARACTER. DREPANA GLAUCATA.

Phalena glaucata, Scopoli, Ent. Carn., p. 221, no. 549 (1764).

Attacus buffa, Linnæus, Syst. Nat. (ed. xii.), i. (2), App., p. 1068, no. 13 (1767).

Bombyx spinula, Denis & Schiffermüller, Syst. Verz. Schmett. Wien. p. 64, no. 6 (1776); Hübner, Eur Schmett., iii., fig. 40 (1800).

Bombyx compressa, Fabricius, Gen. Ins., p. 279 (1777);
Esper, Schmett., ii. (2), p. 24, Taf. 83, fig. 6 (1786).

Platypteryx spinula, Laspeyres, Neue Schrift. Ges. Nat.
Freunde Berl., iv., p. 54 (1803); Treitschke, Schmett.
Eur., v. (3), p. 400 (1826); Duponchel, Lépid. France,
vii., p. 94, pl. 140, no. 7 (1829).

Cilix conspersa, Stephens, Ill. Brit. Ent. Haust., iv., p. 9 (1834).

Cilix glaucata, Kirby, Eur. Butterflies and Moths, p. 124,
pl. 30, fig. 1 (1880); ? Hampson, Fauna Brit. Ind., i.,
p. 347, fig. 238 (1892).

Cilix spinula, Buckler, Larvæ of Brit. Lep., iii., pl. 52,
figs. 2, 2 a (1889), Barrett, Lepid. of Brit. Isl., iii., p. 79,
pl. 100, figs. 2, 2 a-c (1895).



The Chinese Character (*Cilix spinula*).

Larva of *C. spinula*

The Chinese Character is one of the commonest British species of this family, and is often beaten out of hedges. It is white or bluish white, with a grey band through the middle, which does not reach the costa; through this passes a network of silvery nervures, somewhat resembling a stag's horn in shape. Near the hind margin is a row of bluish lunules. The hind-wings are sometimes dusted with grey, and have a grey marginal band.

The larva feeds on sloe. It is reddish-brown of a lighter or darker shade, with two slight elevations on the head, and several small tubercles on the back.

The pupa is formed in a cocoon between leaves. It is elongated; brown in front, and blue behind.

Concerning this species, Sir George Hampson writes: "In American and European specimens, the palpi are minute and porrect; the hind tibiæ have two pairs of spurs; fore-wing with vein 7 separate from 8, 9, 10. In Himalayan specimens, the palpi are absent; the hind tibiæ have but one pair of spurs, and vein 7 of the fore-wing is bent upwards, and almost, or quite, anastomoses with 8, 9, 10." Many entomologists would certainly be inclined to regard such differences as amply sufficient to separate two species, if not to indicate them as belonging to different genera, notwithstanding external similarity in shape or colour.

EXOTIC GENERA OF DREPANULIDÆ.

Cyclidia (Guenée) includes some large Indian and Chinese species formerly classed with the *Geometræ*. The type, *C. substigmata* (Hübner), which is common throughout Northern India, measures two inches and a half across the wings, which are varied with white, grey, and brown. There are two zig-zag lines towards the base of the fore-wings, and an oblique dark line runs from the tip to the middle of the inner margin, outside which are two or three black spots above the inner margin. There is also a sub-marginal row of black dots on all the wings, and a large black spot at the end of the cell of the hind-wings, most conspicuous on the under-surface, which is whiter than the upper. The insect resembles a gigantic species of *Drepana* in general shape and colour.

Mimallia amilia (Cramer) is a common South American moth, which measures about two inches across the wings. The antennæ are strongly pectinated, and the abdomen is moderately stout, and extends a little beyond the hind-wings. The fore-wings are narrower than in *Cyclidia*; the costa is somewhat arched, and the tip slightly falcate. The wings are

silvery grey, more or less speckled with black and white, and with coppery-brown bands; on the fore-wings is a large coppery-brown blotch, enclosing two oval transparent spots, giving the moth some resemblance to the *Saturniidae*. The habits of the larva, however, more resemble those of the *Psychidae*, for it constructs itself a case composed of fragments of wood and grains of sand, and the pupa is enclosed in a large silken cocoon.

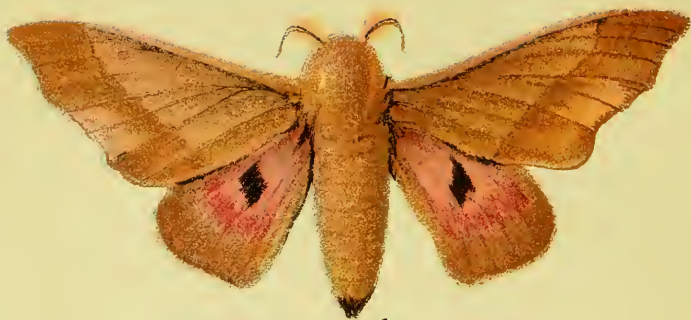
Perophora (Harris) is another American genus, which is found as far south as Buenos Aires. The type of the genus, *P. melsheimeri* (Harris), is also its most northern representative, being widely distributed in the United States, though far from generally common. It is a stout-bodied moth, with strongly-pectinated antennæ, and measures about an inch and a half across the wings, which are rather short and broad, the costa of the fore-wings being arched, and the tip moderately hooked. It is reddish-grey, dusted with black, with a dark oblique stripe running from the costa of the fore-wings, before the tip, to beyond the middle of the inner margin of the hind-wings; there is also a black discoidal spot on the fore-wings. The habits of the larvæ of *Perophora* are curious. They construct for themselves a tough case of leaves, about an inch long, and open at one end. These narrow open cases are so characteristic as to be instantly recognisable as belonging to this genus.

FAMILY XXXI. CERATOCAMPIDÆ.

Eggs.—Elliptical, flattened, sometimes laid in clusters.

Larva.—Hairy, and armed with long horns or spines.

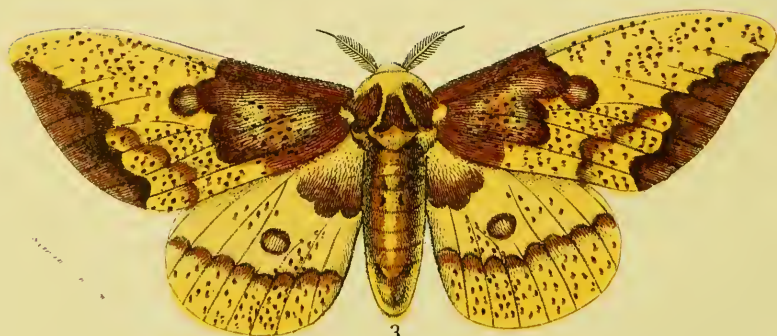
Pupa.—Subterranean, and furnished with strong prickles towards the hinder extremity of the body.



1.



2.



3.

1. *Syssisphinx molina*.
2. do. do, larva.
3. *Githeronia imperialis*.

Imago.—Of large or moderate size, and bright colours, yellow and red usually predominating; body stout, and pilose, as long, or longer, than the hind-wings; proboscis and palpi small; antennæ of the males strongly bi-pectinated to the middle, and simple towards the tip; those of the female filiform; wings long, moderately broad, entire, only slightly ocellated, if at all; frenulum absent; hind-wings with two sub-median nervures.

This is an exclusively American family of small extent, but including several very large and handsome species. Those found in North America are, with the exception of the *Sphingidæ* and *Saturniidae*, the most beautiful and conspicuous moths in the country.

GENUS SYSSISPHINX.

Syssisphinx, Hübner, Verz. bek. Schmett., p. 143 (1822?); Walker, List Lepid. Ins. Brit. Mus., vi., p. 1503 (1855).

This genus includes only one species, which is found in Mexico and South America. The antennæ are short, and very strongly pectinated to the middle in the male, and serrated beyond; in the female they are simple. The palpi are very short. The fore-wings are long, rather narrow, slightly pointed at the tips, and oblique, and in the male slightly angulated along the hind margin.

SYSSISPHINX MOLINA.

(Plate CXIII., Fig. 1; larva, Fig. 2.)

Bombyx molina, Cramer & Stoll, Pap. Exot., iv., pl. 302, figs. E, F (1781?); iv., pl. 396, fig. B (1782); v., pl. 22, figs. 4, 4 D (1790).

Syssisphinx molina, Walker, List Lepid. Ins. Brit. Mus., vi., p. 1503, no. 1 (1855); Druce, Biol. Centr. Amer. Lepid. Het., i., p. 172 (1886).

Psephopaëctes simulatilis, Grote and Robinson, Trans. Amer. Ent. Soc., i., p. 6, pl. 1, fig. 1 (1867).

Adelocephola grandis, Grote and Robinson, Ann. Lyceum Nat. Hist. N. York, viii., p. 8, pl. 1, fig. 7 (1867).

This is one of the smaller moths of the family, averaging only about three inches in expanse. The fore-wings are fawn-coloured, with two oblique brown lines, and the hind-wings are rose-coloured, with a large black spot on the disc. Nearer the hind margin, which is broadly fawn-coloured, is a rusty fascia.

The larva, which has been described and figured by Stoll, is green, humped before and behind, with several pairs of short yellow tubercles, tipped with red; behind these is a yellow lateral line, edged with white below; below this, the incisions are striped with red. The spiracles are reddish, but the two last are circled with yellow, and the hinder segments of the body are thickly spotted with red. When full-fed it changes to a violet-brown pupa with a forked tail, in a slight cocoon just beneath the surface of the ground, and the moth appears in eight days.

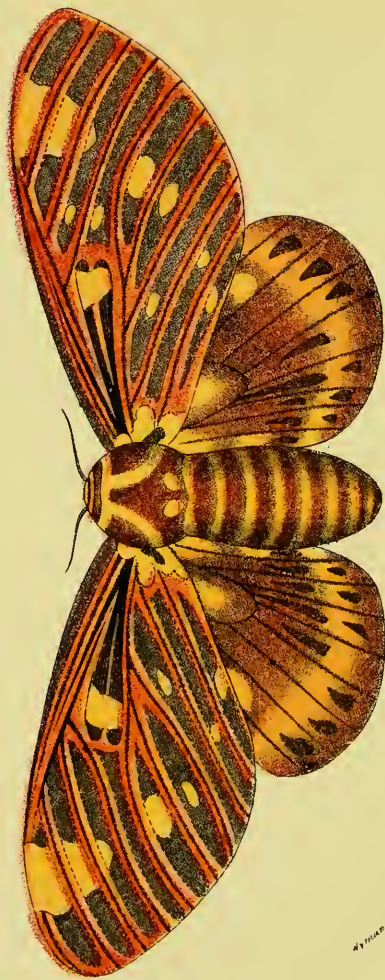
The moth is found in Mexico and Surinam, and the larva feeds on a kind of banana called "Baccoves" in the latter country.

GENUS CITHERONIA.

Citheronia, Hübner, Verz. bek Schmett., p. 153 (1822?).

Eacles, Hübner, *op. cit.*, p. 153 (1822?); Walker, List Lepid. Ins. Brit. Mus., vi., p. 1370 (1855).

Ceratocampa, Harris, Cat. Ins. Mass., p. 591 (1834); id. Rep. Ins. Mass., p. 287 (1841).



Hyphantidius regalis Linn. 1767

Citheronia regalis.

Dorycampha, Duncan in Jardine's Nat. Libr., Exot. Moths, p. 161 (1841).

Basilona, Boisduval, Ann. Soc. Ent. France (4), viii., p. 317 (1868).

This genus includes most of the larger and handsomer moths of the family. Their bodies are very stout, and as long, or longer, than the fore-wings, which are about twice as long as broad, with the costa arched, the tip well marked, but not very acute, and the hind margin rounded off obliquely. The hind-wings are oval, nearly as broad as long, about half as long as the fore-wings, with all the angles completely rounded off.

I have figured two species, representing rather different sections of the genus.

THE REGAL MOTH. CITHERONIA REGALIS.

(Plate CXIV.)

Attacus laocoon, Cramer, Pap. Exot., ii., pl. 117, figs. B, C (nec fig. A), (1777); Stoll, Suppl. Cram., pl. 42, fig. 2 (1790).

Bombyx regalis, Fabricius, Ent. Syst., iii. (1), p. 436, no. 93 (1793).

Phalæna regia, Abbot & Smith, Lepid. Georg., ii., pl. 61 (1797).

Zeuzera regalis, Peale, Lepid. Amer., pl. 5 (1833).

Dorycampha regalis, Duncan in Jardine's Nat. Libr., Exot. Moths, p. 161, pl. 18 (1841).

Eacles laocoon, Walker, List Lepid. Ins. Brit. Mus., vi., p. 1372, no. 2 (1855).

Ceratocampa regalis, Boisduval, Ann. Soc. Ent. France (4), viii., p. 311 (1868).

Citheronia regalis, Comstock, Manual Ins., pp. 345, 346, fig. 424 (1895).

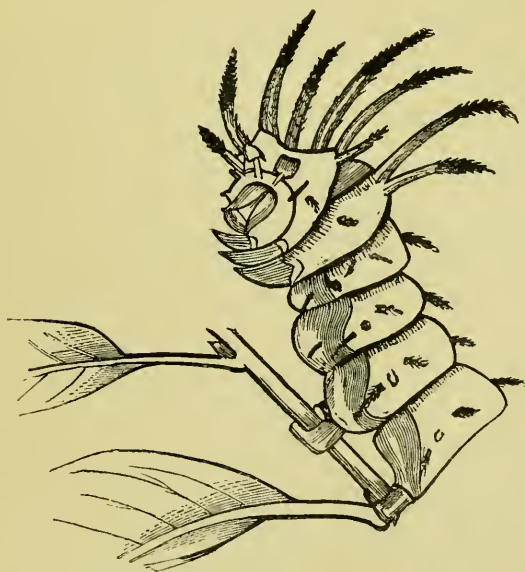
This species, which is the type of the genus *Citheronia* (= *Ceratocampa* and *Dorycampa*), is common in many parts of North America, and measures five or six inches across the wings.

The wings are rounded, especially in the female. The fore-wings are greyish-brown, darker or lighter in different specimens, with a row of large yellow spots at the base and another beyond the middle, a large spot at the end of the cell, and several smaller ones on the disc. The nervures are rather broadly bordered with red on both sides. The hind-wings are reddish-brown with red nervures, a few yellow spots along the costa, an indistinct yellow band beyond the middle, and a sub-marginal row of triangular spots. The head is yellow, the thorax reddish-brown, banded and spotted with yellow, and the abdomen is reddish-brown, with a yellow band on each segment.

The full-grown larva measures about five inches and a half in length. It feeds on Persimmon (*Diospyros virginiana*, Linn.), Walnut, Hickory, and Sumach. It is yellowish-green, inclining to blue, with several black bristly spines on each segment; the spines on the three thoracic segments are very long, curved and granulated, and are reddish-yellow, tipped with black. These large spines give the larva a most formidable appearance, especially when it raises its head and draws the front segments together, as it is in the habit of doing when disturbed. At the same time it shakes its head from side to side as if preparing to make an attack. The negroes of the Southern States of America call it the "Hickory Horned Devil," and Abbot says that they are so afraid of it that he never saw anyone who would venture to handle it, the people in general dreading it as much as a rattlesnake. "Nevertheless," he adds, "it is perfectly harmless, neither stinging by its horns nor any other part. When I have handled this

animal in the presence of the negroes, to convince them it was innocent, they would reply that it could not sting me, but would them."

Abbot found one specimen enter the ground on June 16th,



Larva of *Citheronia regalis*.

and the imago emerged on July 27th; another remained in the pupa-state from August 5th to May 9th.

The pupa is rather short and thick, with a small spine at the extremity; but the edges of the segments are without spinules, unlike those of *C. imperialis*.

THE IMPERIAL MOTH. CITHERONIA IMPERIALIS.

(Plate CXIII., Fig. 3.)

- Attacus imperialis*, Drury, Ill. Exot. Ent., i., pl. 9, figs. 1, 2 (1773); Stoll, Suppl. Cramer, pl. 42, fig. 1 (1790).
Phalæna imperatoria, Abbot & Smith, Lepid. Georg., ii., pl. 55 (1797).
Bombyx didyma, Palisot de Beauvois, Ins. Afr. Amér., p. 52, pl. 20 (1855).
Ceratocampa imperialis, Duncan in Jardine's Nat. Libr., Exot. Moths, p. 158, pl. 17, fig. 1 (1841).
Eacles imperialis, Walker, List Lepid. Ins. Brit. Mus., vi., p. 1371, no. 1 (1855).
Basilona imperialis, Boisduval, Ann. Soc. Ent. France (4), viii., p. 318 (1868); Comstock, Manual Ins., pp. 346, 347, fig. 425—larva (1895).

This species is the type of *Eacles* (Hübner) = *Basilona* (Boisduval). It is a large North American moth, which expands from four to six inches across the wings. The antennæ are reddish-brown, and the head, thorax, and abdomen yellow; the two latter clouded and spotted with light reddish-brown, with a purple gloss. The wings are bright yellow, with numerous small reddish-brown dots, glossed with purple, scattered over the surface. The fore-wings have a large patch of the same colour on the hind margin, and another at the base, extending nearly to the middle of the wing. Between them is a curved reddish-brown band, running from the inner margin. The hind-wings have a purplish-brown patch near the base, a brown eye centred with lighter brown in the middle of the wing, and a waved purplish-brown band beyond it. The under side is of the same bright yellow colour, with a sprinkling of brown dots, each wing with a

reddish-brown eye in the middle, that on the fore-wings having a round brown spot above it ; but all the large spots have disappeared, except those along the costa and hind margin. The female is much larger and lighter-coloured than the male.

The larva feeds on the plane-tree (*Platanus occidentalis*, Linn.), oak, pine, &c. It varies much in colour, being tawny, orange and tawny, and occasionally green. It has two short rugose horns on the second and third segments, and some small sharp points on the others, crowned with dense tufts of long rigid bristles. There is a small yellow spot, surrounded by a black ring, on the sides of each of the abdominal segments.

This species is double-brooded. "The caterpillar," says Abbot, "went into the ground September 16, and came out July 4th. The caterpillars are not common, and are the most difficult to bring to perfection in confinement, as they will not eat in that situation ; and even if they change into a chrysalis, they die afterwards."

The pupa is rather long and narrow, with a long tail, bifid at the end, and the edges of the segments armed with a regular series of spines.

The moth is not uncommon in many parts of the United States.

FAMILY XXXII. SATURNIIDÆ.

Egg.—Large, smooth, slightly depressed, white, or green.

Larva.—Sixteen-legged ; and bearing warts with whorls of hairs, or furnished with long fleshy spines ; often secreting a white waxy powder when half-grown ; usually feeding on trees.

Pupa.—Generally enclosed in a strong silken cocoon, sometimes egg-shaped and closed, sometimes flask-shaped and open at one end ; frequently enclosed in a leaf, and attached to the branch by a strong strand of silk ; rarely naked and subterranean.

Imago.—Large, or very large (rarely less than an inch and a half in expanse, and occasionally attaining the dimensions of a foot in expanse). Antennæ short, strongly bipectinated, especially in the males; mouth parts rudimentary; body stout, rarely as long as the hind-wings, and frequently only half as long; wings broad, cells usually closed; fore-wings sometimes more or less pointed, produced at the tip; hind-wings with no frenulum, with one sub-median nervure, and sometimes tailed. All the wings have usually a large central ocellus, generally round, but sometimes irregular in shape, sometimes opaque, and sometimes perfectly hyaline; legs short and stout, without spurs.

GENUS ATTACUS.

Attacus, Linnæus, Syst. Nat. (ed. xii.), i. (2), p. 809 (1767);
Hübner, Verz. bek. Schmett., p. 155 (1822?); Walker,
List Lepid. Ins. Brit. Mus., v., p. 1200 (1855).
Hyalophora, Duncan in Jardine's Nat. Libr., Exot. Moths,
p. 124 (1841).

This genus includes the largest Lepidopterous insect known, the great Atlas Moth of India (*Attacus atlas*, Linnæus), the largest specimen of which, in the British Museum, measures eleven inches and three quarters across the tips of the wings, though most specimens measure only eight or nine inches in expanse. It is very variable both in size and colouring, apart from the numerous more or less well-marked local forms, which some entomologists regard as distinct species. The costa of the fore-wings is arched, and the tip forms a rounded hook, the hind margin below forming a very obtuse curve. Body very short, less than half as long as the hind-wings, which are much produced towards the anal angle; the hind margin forming a very long curve.

The moths are varied with reddish-brown, fawn-colour, white, and black, and there are two festooned white, black-bordered transverse stripes on each wing (angulated on the fore-wings), one towards the base, the other beyond the middle of the wing. The point of a large vitreous triangle rests on the inner side of the outer white band, and above that, on the fore-wings, is often a second long vitreous spot. The tip of the fore-wings is paler and more varied in colour than the rest of the wing, and is marked with one or two sub-ocellated spots, and there is a sub-marginal row of black spots bordered with yellowish. The body is streaked and belted with white.

The larvæ feed on various trees ; when young, they are black with white spines, but they afterwards become green, with bluish-green or blackish spines ; when half-grown they become covered with a white powder, and they always eat their skins after casting them ; a curious habit found in many larvæ. It has been suggested that the object of this is to prevent the empty egg-shells and cast skins furnishing an indication of the whereabouts of the larvæ to birds or other enemies.

Attacus edwardsii, White, is another very handsome and much rarer North Indian species. It is of a more uniform size, expanding about nine or ten inches, and is of a much darker and richer colouring than *A. atlas*, and is altogether a handsomer insect.

Many species of *Attacus* are found in Mexico and South America. They have a strong general resemblance to *A. atlas*, but are smaller, averaging from four to six or seven inches in expanse. They differ from each other chiefly in colouring, and in the shape of the vitreous spots, which, in some species, are regularly oval instead of being triangular.

Coscinocera (Butler) is a genus including one or two species found in North Australia and New Guinea. They measure

about eight inches in expanse, and much resemble *Attacus* in colour and general appearance, but the eye-spots are rounded, and the hind-wings are produced into very long and very broad tails, curving outwards.

There are other *Saturniidae* with shorter or longer tails, belonging to *Tropæa* (Hübner), *Actias* (Leach), &c. They measure from two to five inches across the fore-wings, which are usually pointed, and sub-falcate, and they are most numerous in China and North India; and single species are found in North America, Natal, and Spain. The species are mostly of a glaucous green (sometimes darker), with a large lunule in each wing.

There are other tailed species in West Africa and South America (*Eudæmonia*, Hübner, &c.), which measure two or three inches across the fore-wings. The hind-wings are produced into very long slender tails, often nearly six inches in length.

GENUS PHILOSAMIA.

Philosamia, Grote, Proc. Amer. Phil. Soc., xiv., p. 258 (1874).
Samia, Hübner, Verz. bek. Schmett., p. 156 (1822?); Grote,
Proc. Ent. Soc. Philad., v., p. 228 (1865).

This genus differs from *Attacus* chiefly in the shape of the vitreous spot, which forms a long narrow lunule, bordered with yellow and black. The outer white band varies considerably in breadth, and is often bordered with a pinkish suffusion on the hind-wings. The species are smaller than *Attacus*, averaging five or six inches in expanse. There are many closely allied forms in the East Indies, perhaps not all truly distinct; they were formerly classed as one species under the name of *Attacus cynthia*, Drury. They feed on the castor-oil plant, *Ailanthus glandulosa*, and other trees, and



1. *Philosamia lunula*.

2. *Antherea mylitta*.

are reared in the East for the sake of their silk. Successful attempts have been made to introduce them into Europe and America, and they are naturalised in some places, but the silk is coarser than that of *Bombyx mori*, and is generally carded, owing to the difficulty of winding it; and it is, therefore, of much less commercial value.

Some African species allied to *Attacus*, with falcate wings and narrow lunules on the fore-wings, are provisionally referred to *Philosamia*; while others, with broad, non-falcate wings and oval vitreous spots form the genus *Epiphora* (Wallengren).

THE ARRINDI SILKWORM MOTH. PHILOSAMIA LUNULA.

(Plate CXV., Fig. 1; larva, Plate CXVIII., Fig. 1.)

Phalæna cynthia, Rochebrune (nec Drury), Trans. Linn. Soc. Lond., vii., p. 42 (1804).

Saturnia cynthia, Duncan in Jardine's Nat. Libr. Exot. Moths, p. 141, pl. 4, fig. 1 (1841).

Attacus lunula, Walker, List Lepid. Ins. Brit. Mus., v., p. 1221, no. 18 (1855).

Saturnia arrindi, Royle, Rep. Paris Exhib., iii., p. 216 (1856).

Attacus ricini, Hutton, Journ. Agric. Hort. Soc. India, xiii., p. 71 (1863).

Philosamia lunula, Butler, Ill. Lepid. Heter. Brit. Mus., v., p. 60, pl. 94, fig. 1 (1881).

This species measures four or five inches across the wings, which are of a yellowish-olive, darkest towards the base. The fore-wings are sub-falcate in the male, the hind margin being much more concave than in the female; the abdomen is very short, and the hind-wings are long, and distinctly narrowed towards the anal angle; in the female they are broader. In the centre of each wing is a large white

lunule, edged with yellow and black. A white, slightly undulating, band runs obliquely across the wings, from beyond the middle of the costa of the fore-wings to the inner margin within the anal angle; it is edged outside with black and pink. The abdomen is banded with white, and opposite the largest belt a white band runs from the base of the fore-wings to the transverse band, and another very oblique band runs from the costa near the lunule, uniting with the straight one, and throwing off one or two slender branches to the transverse band. The transverse white band of the hind-wings curves round to the base below the costa. The tip of the fore-wings is varied with yellow and pink, and is marked with a round black spot, partly bordered with white. The hind margin is grey, intersected by one or two blackish lines.

The species of *Philosamia* are semi-domesticated in the East, and are imperfectly segregated. The larvæ feed on *Ailanthus glandulosa*; *Ricinus* (Castor-oil plant), &c. The larva is green, spotted with black, and with numerous fleshy tubercles; when about half-grown it is paler than when full-grown, and is covered with a white waxy powder. The cocoon is white, yellow, or light-brown, and is formed in a leaf, which is attached to the branch by a strong strand of silk, so that it cannot fall off. The silk cannot be wound, but is spun like cotton, and makes a loose but exceedingly durable cloth. The species of *Philosamia* are easily reared and acclimatised in Europe and America, but their silk is not of sufficient value to make it a profitable speculation.

The castor-oil plant, and the silkworm feeding upon it, are both called "Arrindi" in India.

GENUS SAMIA.

Samia, Hübner, Verz. bek. Schmett., p. 156 (1822?); Walker,



1. *Samia* ce
2. do.



1.



2.

Wymann & Co. London.

List Lepid. Ins. Brit. Mus., v., p. 1222 (1855); Packard, Proc. Ent. Soc. Philad., ii., p. 380 (1863).

Platysamia, Grote, Proc. Ent. Soc. Philad., v., p. 229 (1865).

Body stout and short, not more than half as long as the hind-wings; antennæ long, strongly pectinated; head small; face nearly covered with drooping hair; wings with a curved ocellus in the centre of each; fore-wings considerably longer than broad, and rounded at the extremity; hind margin oblique, hardly concave; hind-wings rounded, hardly longer than broad.

This genus is confined to North America, and the commonest species, which we have figured, is found in the United States and Canada. It is the largest species of the *Saturniidae* which inhabit temperate North America.

SAMIA CECROPIA.

(Plate CXVI.)

Bombyx cecropia, Linnæus, Syst. Nat. (ed. x.), i., p. 447, no. 3 (1758); id., Mus. Ludov. Ulricæ, p. 368 (1764); Clerck, Icones, pl. 49, fig. 1 (1764); Hübner, Eur. Schmett., iii., fig. 282 (1818).

Attacus cecropia, Drury, Ill. Exot. Ent., i., pl. 18, fig. 2 (1773); Cramer, Pap. Exot., i., pl. 42, figs. A, B (1775); Abbot and Smith, Lepid. Georgia, i., pl. 45 (1797).

Hyalophora cecropia, Duncan in Jardine's Nat. Libr., Exot. Moths, p. 132, pl. 11 (1841).

This fine insect is one of the largest North American moths, measuring upwards of six inches between the tips of the wings.

The antennæ are black, broadly pectinated; the head small and red; the collar white; the thorax covered with long

reddish-brown hair; the abdomen with orange-brown and white bands of uniform breadth, the latter edged behind with black. The wings are reddish-brown, the fore-wings with the basal area orange-brown, bounded externally by a narrow angulated whitish band, extending from the inner margin nearly to the costa. The disc is rusty-brown, with a large white curved central spot, edged with black and tinged with reddish-brown; beyond this there is a broad reddish-orange band bordered within with white. The tips of the wings are brown, powdered with grey. There is a round black spot near the tip, with a light-coloured crescent within it. A white zig-zag band runs from the black spot to the costa. The marginal area is buff externally and yellow internally, bounded within by a narrow black line. The hind-wings are similar to the fore-wings, but the white discoidal spot is larger, the transverse band broader, and more bordered with white on its inner side; the hind margin is dull buff, with two faint black lines, and a row of long black curved spots. All the markings are brighter and more distinct on the under side. The hind-wings are bordered with white along the costa, broadening as it nears the tip.

The larva feeds on wild American plum (*Prunus pennsylvanicus*), but is said to eat apple in confinement. It is green, with a yellow head and legs, and numerous projections of the same colour on the body, and there are two blue spots on each segment. It spins its cocoon on a branch of the food-plant. The cocoon is larger than a pigeon's-egg, and yellowish-brown in colour, the outer layer of silk being coarse, but the inner portions finer. The silk has been utilised for making stockings, after being carded and spun, and Abbot says it will wash like linen. The insect is common in many parts of North America, and other closely-allied species of the genus are met with in the Northern and Western States.

I am not aware that any attempts have recently been made



1. *Callosamia promethea*.
2. do. do, ♀ under side.
3. do. do, larva.
4. do. do, cocoon.
5. do. do, pupa.

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to utilise the silk of this or the other North American *Saturniidae* commercially. Abbot calls it rare in Georgia; but, as a dealer, he indicated almost every insect as being "rare."

GENUS CALLOSAMIA.

Callosamia, Packard, Proc. Ent. Soc. Philad., iii., p. 379 (1864).

This is another genus which includes only a few species, which are confined to North America. It is allied to *Samia*, but the head is narrower and less hairy, the body is much more slender, and much shorter than the hind-wings, and the antennæ, though broadly pectinated, are rather short. The wings have a curved or angulated mark in the middle, at least on the under side, the fore-wings are not much longer than broad, and are sub-falcate in the male, the hind margin being deeply concave below the tip, and the hind-wings form a long oval, being much longer than broad.

CALLOSAMIA PROMETHEA.

(Plate CXVII.)

Attacus promethea, Drury, Ill. Exot. Ent. ii., pl. 11, figs. 1, 2; pl. 12, figs. 1, 2 (1773); Cramer, Pap. Exot., i., pl. 75, figs. A, B; pl. 76, figs. A, B (1775); Abbot and Smith, Lepid. Georg., i., pl. 46 (1797).

Saturnia promethea, Peale, Lepid. Amer., pls. 3, 4 (1833).

Hyalophora promethea, Duncan in Jardine's Nat. Libr., Exot. Moths, p. 134, pl. 12 (1841).

This is another handsome and fairly common North American moth, which expands about four inches across the wings. The male is dark chocolate-colour, with the outer third of the wings lighter, and bordered within by a more or less distinct whitish line. The fore-wings are hooked. The

hind margins are light greyish-brown, intersected by a slender black waved sub-marginal line.

Near the apex of the fore-wings is a round black spot, surmounted by a blue crescent. The hind-wings have a row of elongated black spots within the narrow black sub-marginal line. The markings of the under side resemble those of the upper, but the colour is paler, and there is a white transverse spot in the middle of each wing. The female is very different from the male. The body is reddish-brown, and the basal half of the wings is dark red, intersected by a white angulated band, beyond which is a rather large triangular whitish spot in the centre, and a waved band of the same colour bounding the dark-red portion, and bordered on its inner side by dark chocolate. The tips of the fore-wings have a round black spot partly encircled with blue, and from the base a whitish line runs outwards nearly to the triangular spot, and then upwards to the costa. The hind margins are dark buff colour, with a narrow zig-zag sub-marginal black line, within which, on the hind-wings, is a row of irregular reddish spots. The under side of the body is streaked with white, the colours are paler, and the angular band towards the base of the fore-wings is absent, whilst the light-coloured portions are dusted with grey.

Peale (in his "Lepidoptera Americana") gives an interesting account of this moth, which is quoted here in full, as the book is of extreme rarity :—

"During the present year (1833) this beautiful moth will be unusually abundant in the vicinity of Philadelphia, judging from the number of cocoons which are to be seen hanging from the branches of Sassafras (*Laurus sassafras*) and Spice-wood (*L. benzoin*). The casual observer would no doubt suppose them to be merely withered leaves that have withstood the blasts of winter, for such they were evidently intended to resemble by the little architect when preparing its narrow cell.

The naturalist, however, is not to be thus deceived, as a boy and myself collected from three to four hundred specimens during short winter rambles in the neighbourhood.

“The perfect insects appear about the end of May and beginning of June, at which time the leaves of the Sassafras, Spice-wood, and Swamp Button-wood (*Cephalanthus occidentalis*) have attained a sufficient size to afford a plentiful supply of food to the caterpillar; the parent insect most commonly selecting those trees for the sustenance of her future progeny, and depositing her eggs on or near the leaves which have been chosen for that purpose.

“The caterpillar casts its skin three or four times, increasing in bulk and brilliancy of colour with each change, and finally attains the size represented in our figure; it then loses the voracious appetite which has hitherto been its predominant character, and begins its preparations for the great transformation it has to undergo, by selecting a perfect leaf, the upper surface of which it covers with a fine, light, yellowish-brown silk, extending this coating, with great skill and foresight, over the foot-stalk of the leaf, and attaching it firmly to the branch, so as to secure the leaf from being separated by any accident. This preliminary having been accomplished, the caterpillar next draws the edges of the leaf together; thus forming a perfect external covering or mantle, in which it spins a fine, strong, durable cocoon of fine silk. In this habitation our little architect passes the winter, secure from birds and other enemies (see plate cxvii., fig. 4). As soon as the cocoon has been completed the caterpillar again sheds its skin, and is transformed into a pupa or nymph (plate cxxii., fig. 5). At first, the leaf enveloping the cocoon remains green, but soon changes to a red or brown colour, when it becomes brittle, and is gradually carried away by the winds and storms of the winter, until finally nothing remains except the cocoon itself,

which is firmly suspended by the silk which once covered the foot-stalk of the leaf. The instinct of the caterpillar, in thus providing for the permanent attachment of its future habitation, appears to be superior to that shown by many other species.

"The caterpillar is of a delicate green colour, with yellow feet; each segment of the body, except the posterior, is marked with six blue spots, from which arise small black tubercles; in the second and third segments, however, the two centre tubercles are replaced by club-like projections of a third of an inch in length, and of a bright coral-red colour. The last segment is furnished with but five tubercles, the central one of which is of the same clavate form as those on the anterior segments, but is of a fine yellow colour. As before stated, they feed on the leaves of the Sassafras, Spice-wood, and Swamp Button-wood, and are to be found during most of the autumn months.

"The silk spun by this species is as fine, and is produced in as great abundance, as that furnished by the *Bombyx mori* (or the silkworm usually reared for manufacturing purposes, which was originally a native of Asia), but is of a darker colour, and will, it is feared, always present difficulties in reeling, from the manner in which part of it is attached to the branch."

GENUS BUNÆA.

Bunæa, Hübner, Verz. bek. Schmett., p. 154 (1822?);
Walker, List Lepid. Ins. Brit. Mus., v., p. 1226 (1855).

The genus *Bunæa* and its allies include a number of large and handsome African moths, measuring seven or eight inches across the wings, and varying from brown or fawn-colour to nearly black. There is usually a large ocellus of



1. *Philosamia lunula*, larva.
 2. *Antheræa mylitta*, larva.
 3. do. do, cocoon.

various colours on the hind wings, and a vitreous triangular or conical spot on the fore-wings. The latter are rather long and pointed, and the hind wings rounded, more or less lobate, or even sub-caudate.

GENUS ANTHÆRÆA.

Anthæræa, Hübner, Verz. bek. Schmett., p. 122 (1822?);
Walker, List Lepid. Ins. Brit. Mus., v., p. 1239 (1855);
Moore, Lepid. Ceylon, ii., p. 121 (1883).

This genus, even though restricted to *A. mylitta* (Drury) and its immediate allies, is one of the most extensive of the *Saturniidae*, and is represented by a considerable number of yellow, fawn-coloured, and brown species in Asia and Africa, mostly averaging five or six inches in expanse. There is generally a large round ocellus on each wing, which is sometimes entirely opaque, but frequently consists almost wholly of a large round vitreous spot, or contains one in the centre. The antennæ are strongly pectinated, especially in the male, and the fore-wings are rather pointed, and in the male usually more or less falcate; the hind margin is oblique, and rounded off at the hinder angle. The hind-wings are rounded. A white line, bordered inside with red or brown, crosses all the wings near to, and parallel with, the hind margin; and there are some indistinct transverse brown lines on various parts of the wings. The larvæ construct a large egg-shaped cocoon, and the silk of several species is of great value in India, China, and Japan.

THE TUSSEH SILKWORM MOTH. ANTHÆRÆA MYLITTA.

(Plate CXV., Fig. 2; larva and cocoon, Plate CXVIII., Figs. 2, 3.)

Attacus mylitta, Drury, Ill. Exot. Ent. ii., pl. 5, fig. 1 (1773).

Attacus paphia, Cramer (nec Linn.), Pap. Exot., ii., pl. 146, fig. A; pl. 147, figs. A, B; pl. 148, fig. A (1777).

Saturnia mylitta, Guérin, Rev. Zool., 1855, pp. 6, 297, pl. 6, fig. 2.

Antheræa mylitta, Walker, List Lepid. Ins. Brit. Mus., v., p. 1247, no. 8 (1855).

There are a considerable number of imperfectly-segregated local forms of this species, several of which have received distinctive names. It would therefore be useless to give a detailed description; but in general terms it may be said that the male is fawn-coloured, more or less varied with brown or yellow, and generally yellowish towards the tips of the fore-wings. There is a large, round, talc-like, transparent spot on each wing, crossed by a line like a crack, and enclosed in two yellow rings, separated by a brownish-grey space, and bordered by an outer black ring. The outer yellow ring is incomplete, and on its inner side is replaced by a narrow bluish-white crescent, bordered on both sides with red within the outer black ring. The brown or pink sub-marginal line is well marked, and edged outside with white. The female is lighter fawn-colour, or yellow, and the fore-wings are hardly falcate. The pro-thorax and the costa of the fore-wings are light grey. Drury's figure of the male measures nearly six inches in expanse; it is reduced on our plate, and it appears to correspond best to a dark form from Northern India, sometimes called *Antheræa nebulosa* (Hutton).

The Indian silkworms, which produce the so-called Tusseh silk, are the larvæ of *A. mylitta* and its allies. They are found on *Zizyphus jujuba*, *Terminalia alata*, *Bombax heptaphyllum*, and other trees, and are usually watched by the natives on the trees, and not reared in actual captivity. The larvæ are yellowish green, with a light yellow lateral stripe,

and golden spots beneath ; there are also brown spots on the back, on which stand a few long bristles. When they are full-grown they are too heavy to walk on the upper side of the branches of the trees, but walk with their backs downwards. The cocoon is enclosed in one or more leaves, and attached to the branch by a strong peduncle.

The silk can be wound without very much difficulty, and yields a coarse, dark-coloured, and very durable silk, which is woven into a kind of cloth which is much used by the natives.

The oak-feeding silkworms of China and Japan (*Antheræa pernyi* and *A. yamamai* of Guérin-Ménéville) are so similar to *A. mylitta*, besides being extremely variable, that they might easily be supposed to have been off-shoots from the same stock at no very distant date. Both of them yield a valuable silk ; and attempts have been made to rear them in Europe, but with no very great success, as they are by no means as hardy as the far less valuable *Attacus cynthia* and its allies.

GENUS GYNANISA.

Gynanisa, Walker, List Lepid. Ins. Brit. Mus., vi., p. 1267 (1855).

This genus differs from its allies in having the wings coarsely scaled, and the hind margins slightly denticulated. The costa of the fore-wings is arched towards the tip, which is rather pointed, but not hooked, and the hind margin is oblique. The hind-wings are very ample, and the abdomen is longer than in many of the *Saturniidae*, extending, in the female, nearly as far as the anal angle. There is a small vitreous spot on the fore-wings, but the eye-spot on the hind-wings is of enormous size, its concentric rings covering almost the whole wing. The antennæ are strongly pectinated, and the palpi are better developed than usual in the *Saturniidae*.

The type of this genus is *G. maia* (Klug), which is common in Natal, where the larva feeds on the mimosa. The moth is dark-brown instead of grey. The larva is green, with silvery tufts, and the Kaffirs make snuff-boxes of the cocoons.

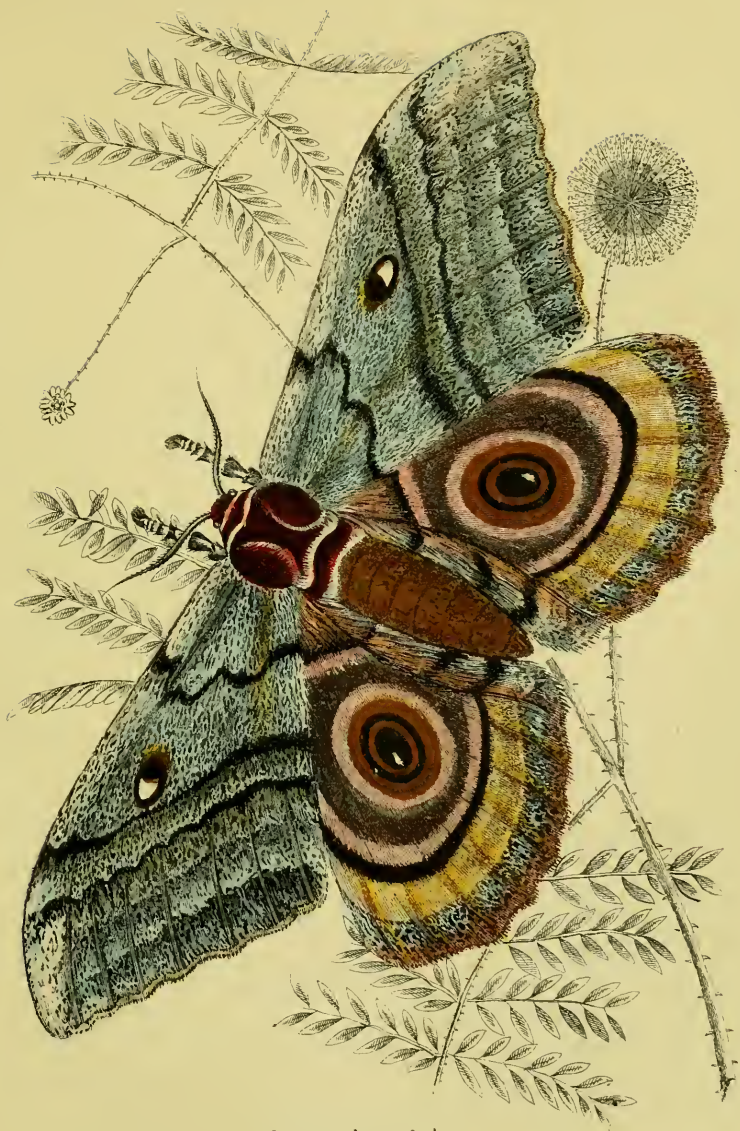
A rather larger and paler moth than *G. maia* is found in Tropical East Africa. The vitreous spot on the fore-wings is much larger, and is set on a diamond-shaped black spot, which rests on one of the dark transverse lines. In the male the wings are subfalcate. It is called *G. westwoodi*, Rothschild.

GYNANISA ISIS.

(Plate CXIX.)

Saturnia isis, Westwood in Jardine's Nat. Libr., Exot. Moths, p. 138, pl. 13 (1841).

"The wings measure very nearly six inches in expanse, and are of a very pale colour, especially the anterior pair, which are, however, almost entirely covered with fine black and brown hairs. The centre of these wings is ornamented with a small oval mark, half of which, towards the body, is covered with black scales, and the other half is vitreous; between this and the base is a very curved and irregularly dentate fascia crossing the wing, and immediately behind the eye is a nearly straight, slender, brown bar. This is succeeded by slender, black wavy bars, the space between which and the apex of the wing is divided into, as it were, three compartments, the first of which is covered with small brown patches, the second is paler and covered with very fine black speckles, and the apical part is much darker, with large black specks. The apical margin of the fore-wings is slightly scalloped, the hind-wings are entirely covered on the upper side by a most magnificent eye-like spot, surrounded by successive rings of



Gynanisa isis.

various colours. The oval pupil is black, but the part furthest removed from the body is denuded of scales, and would be vitreous were not the under side of the wings clothed with scales; this is surrounded by a narrow fulvous iris, then black, then a broader oval of dirty clay-colour, then a narrow oval of pale flesh-colour, then a broad rich claret oval ring; between this and the base of the wing is first a bar of flesh-colour, then black shaded into claret; towards the extremity of the wing the claret is succeeded by a half-ring of flesh-colour, then a narrow one of black, then of pale buff stone-colour, and another moderately broad of grey speckled with black. The thorax is dark and rich brown colour, with two white bands across the neck, and two across the extremity of the thorax whitish; the abdomen is buff, with black dots. The margin of the hind-wings is scalloped and their external angle is considerably produced beyond the hind angle of the fore-wings. The under surface of the wings of this magnificent moth is by no means equal to the upper side in the beauty of the markings, all the wings being of a very pale buffish-white with dark speckles; the fore-wings are marked nearly as on the upper side, but the hind-wings have only a very small eye in the centre, having a black pupil with a fulvous orbit surrounded by a slender black circle; immediately connected with the posterior part of this eye is a curved row of brown arches, between which and the apex of the wings is another and more slightly marked series of black scallops. The palpi are distinct, forming a small brown muzzle, but they are visible from above; they, as well as the rest of the head, are brown. The spiral tongue appears to be wanting, the antennæ are slightly bipectinated, being gradually more slender from about one-third of the distance from the base to the apex. The legs are short."

The typical female specimen from which Westwood's

description and figure were taken is now in the Museum of Science and Art in Dublin. It was probably brought from some part of the coast of Tropical (West) Africa; but the exact locality is unknown.

GENUS ARSENURA.

Arsenura, Duncan in Jardine's Nat. Libr., Exot. Moths, p. 125 (1841).

In this genus, which is confined to Tropical America, the antennæ are shortly but strongly bipectinated in the male (thick and fusiform in the female), the body is moderately stout, and in the female the abdomen is sometimes nearly as long as the hind-wings. The fore-wings are strongly arched before the tip, but the latter is rounded off, and the hind margin is only slightly concave. There are no eye-spots. The hind-wings in the male are nearly square, and the hind margin is deeply concave, making the lower part of the wing sub-caudate (very conspicuously so in some species); as it projects outwards in the females, the concavity is scarcely marked in the latter.

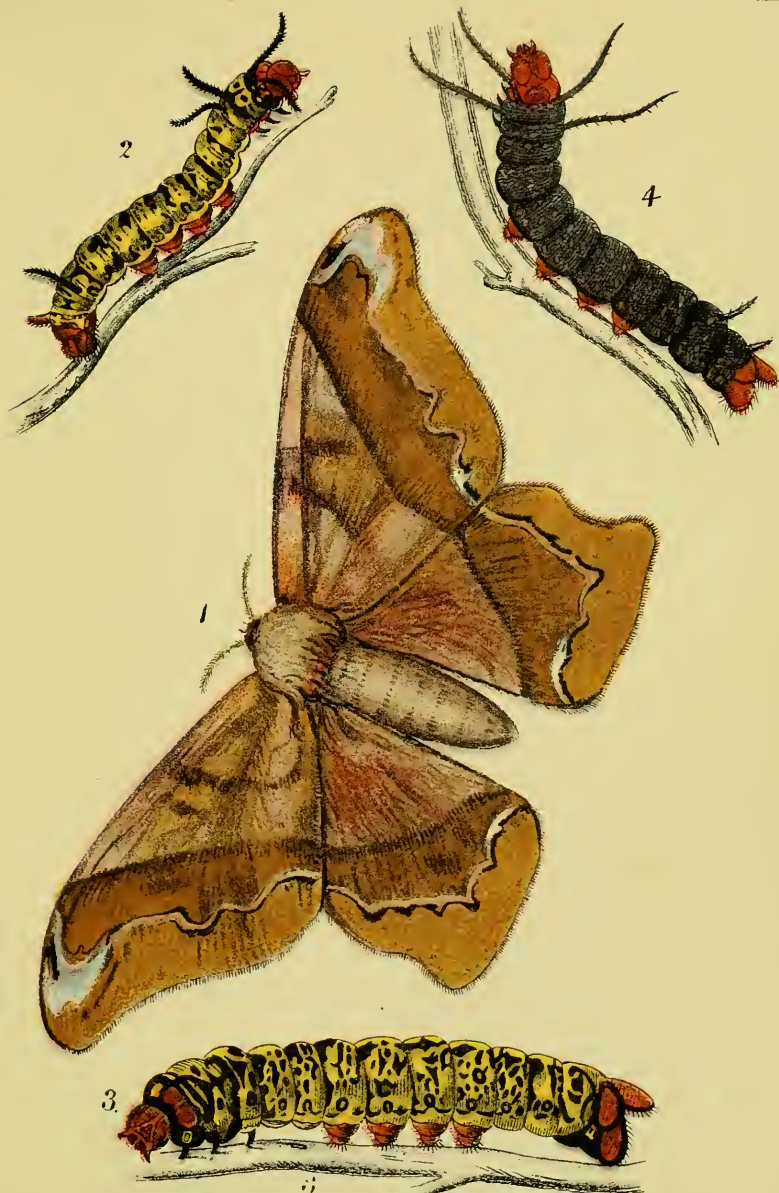
The half-grown larva is provided with four long fleshy filaments towards the head, and two towards the tail, which are lost in the full-grown larva.

ARSENURA CASSANDRA.

(Plate CXX, Fig. 1; larva, Figs. 2, 3.)

Attacus cassandra, Cramer, Pap. Exot., iii., pl. 197, fig. B (1780); Stoll, Suppl. Cram., pl. 19, figs. 2, 2C, 2D (1790).

This species is a native of Surinam and Brazil, and measures five or six inches in expanse, our figure being reduced from $5\frac{1}{2}$ inches (the actual size of the specimen figured)



1 *Arsenura cassandra*. 2. 3. *Arsenura cassandra*, larva.
4 *Arsenura armida*, larva.

to $4\frac{1}{2}$ inches. It is brown, with the fore-wings more or less dusted with grey. Towards the base of the wings are some rather indistinct brown lines, and at two-thirds of the length of the costa, a well-marked brown or reddish line runs obliquely nearly parallel to the hind margin, and is continued more obliquely across the hind-wings. Near the extremity of the costa of the fore-wings is a black spot dusted with blue, placed in a lighter space running to the tip, and below the inner half of this white stripe are two grey curves, bordered outside with white, and inside by a brown or blackish zig-zag sub-marginal line, imperfectly double, and partly filled up with white, running to the inner margin between the transverse stripe and the hinder angle. There is a similar, but broader and more festooned black sub-marginal line on the hind-wings, bordered again with grey or whitish, and this again internally by a narrower and less distinct brown line. In the male, which we have figured, the hind-wings are deeply concave on the hind margin, and are slightly produced outwards at the lower and outer angle; in the female, the concavity is slight, and the wings are more rounded and scalloped. The female is the sex figured by Cramer. It has the hind-wings dark brown between the bands, and slaty-grey towards the base, and the borders of all the wings dark reddish-brown. The larva, which feeds on banana, is yellow, mottled with black, and the head, extremities, and pro-legs are red.

Two other species, likewise occurring in Surinam and in other parts of Tropical America, have been confounded with this. One of these is *A. armida* (Cramer, Pap. Exot., iii., pl. 197, fig. A), which is a dark brown moth, with the space between the transverse stripes filled up with darker brown on all the wings. Cramer's figure represents a male. The larva and pupa are figured by Stoll (pl. 19, figs. 1, 1 A, B), and the former is represented on our pl. cxx., fig. 4. It is black,

with the head, extremity, and pro-legs red, and feeds on a tree which is used in Surinam for posts, &c.

Under the name of *Bombyx erythrina*, Fabricius briefly described an insect in his "Species Insectorum" (ii., p. 169, no. 9 (1781)), under which he included both the foregoing species, and also an insect figured by Madame Merian ("Insectes de Surinam," pl. 11). His description is indefinite, but as he expressly mentions the larva, his name may be retained for Madame Merian's insect, which is clearly distinct from either of the foregoing, being much larger and paler. The larva, which feeds on the so-called "palisade tree," is also very different. There are three broods in the year, and the young larvæ are whitish or yellowish, with the segments bordered with black, then yellow, with black spiracular spots, and finally deep orange-brown, with black spiracular spots, but without the long black filaments which, in common with the larvæ of the other species of the genus, they possess in their earlier stages.

GENUS SATURNIA

Saturnia, Schrank, Fauna Boica, ii. (1), p. 149 (1802); Ochsenheimer, Schmett. Eur., iii., p. 1 (1810); Stephens, Ill. Brit. Ent. Haust., ii., p. 36 (1828); Walker, List Lepid. Ins. Brit. Mus., vi., p. 1268 (1855).

Saturnia, as now restricted, includes a number of species of moderate size, chiefly inhabiting Europe, Asia, and North Africa. They are stout-bodied downy moths, with round, opaque ocelli on the wings, sometimes traversed by a fine vitreous line. The wings are broad, rounded off at the tips of the fore-wings, and with the hind margin regularly curved, and not very oblique. In some species the sexes differ considerably, and in others they are alike. The antennæ are deeply bipectinated in the male, with branches of equal length;



1. *Saturnia pavonia-minor*.
 2. do do larva.
 3. *Henucha grimmia*.

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in the female the branches are much shorter, longer on one side than on the other, and the alternate branches are rudimentary.

The largest species is the Great Peacock Moth (*S. pavonia-major*, Linn.), which is brown, and measures six inches in expanse. It is common in South Europe, and is found as far north as Paris, where the larva feeds on fruit-trees. Most species of *Saturnia* are only half the size of this.

THE EMPEROR MOTH. SATURNIA PAVONIA-MINOR.

(Plate CXXI., Fig. 1; larva, Fig. 2.)

Bombyx pavonia-minor, Linnæus, Syst. Nat. (ed. x.), i., pp. 496, 497, no. 55 (1758); Esper, Schmett., iii., p. 35, Taf. 4, figs. 1-6 (1782).

Bombyx pavonia, Linnæus, Faun. Suec., p. 291 (1761).

Bombyx carpini, Denis & Schiffermüller, Syst. Verz. Schmett. Wien. p. 50, no. 3 (1776); Hübner, Eur. Schmett., iii., figs. 53, 54, 255, 256 (1804?).

Saturnia carpini, Ochsenheimer, Schmett. Eur., iii., p. 6 (1810); Kirby, Eur. Butterflies and Moths, p. 126, pl. 27, figs. 3 a-e (1880); Buckler, Larvæ of Brit. Butterflies and Moths, iii., pl. 53, figs. 1, 1 a-c (1889); Barrett, Lepid. Brit. Isl., iii., p. 57, pls. 97, 98, figs. 1, 1 a, b (1895).

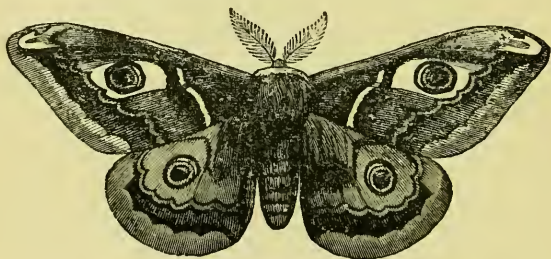
Attacus pavonia-minor, Godart, Lépid. France, iv., p. 68, pl. 5, figs. 2, 3 (1822).

Saturnia pavonia, Stephens, Ill. Brit. Ent. Haust., ii., p. 37 (1828).

The Emperor Moth is found throughout Europe, as well as in Northern and Western Asia, and is the only species of the *Saturniidae* indigenous to the British Islands. The female

sometimes exceeds three inches in expanse of wings, but the male seldom attains more than two and a half.

The male differs from the female in having pectinated antennæ and tawny hind-wings; for the rest, both sexes are greyish, with numerous white scales intermixed, and faintly tinged in several places with purple. The hind margin of all the wings is broadly brownish white. On each wing there are two transverse lines, one near the base, somewhat abbreviated, and consisting of a white, purplish, and dark brown stripe, the other situated beyond the middle, and much waved. In the



The Emperor Moth. Male.

centre of each wing is a large ocellus; this is situated on a whitish ground, and consists of a black pupil, with a whitish streak in it, with a yellow or grey iris, surrounded by a black ring, and surmounted by a reddish and light blue crescent. At the apex of the fore-wings is a patch of purple, with a black and whitish mark upon it. The body is covered with fulvous or brown hairs, and the hinder border of the abdominal segments is whitish.

The female lays 200 or 300 white eggs, which are attached in small clusters to the stalk of the food plant.

The larva feeds on various plants, especially heath (*Calluna vulgaris*), blackthorn, bramble, willow, &c. It is black at first,

but after the last moult becomes of a beautiful green colour, with each of the segments cinctured by a black band, which is adorned with a series of pink tubercles, each bearing a whorl of six hairs, diverging like a star, the central one being the longest. The pupa is enclosed in a flask-shaped cocoon, open at the narrowed end.

GENUS HENUCHA.

Henucha, Geyer in Hübner's Samml. Exot. Schmett., iii., pl. 1 (1837?); Walker, List Lepid. Ins. Brit. Mus., vi., p. 1331 (1855).

The type of this genus is a very rare and beautiful South African moth, of moderate size, and with rounded wings. It is not congeneric with the commoner species associated with it by Walker, which have longer and less rounded wings; but it is not worth while to attempt to characterise the genus in detail from Geyer's figure of the female.

HENUCHA GRIMMIA.

(Plate CXXI., Fig. 3.)

Henucha grimmia, Geyer in Hübner's Samml. Exot. Schmett., iii., pl. 1 (1837?); Walker, List Lepid. Ins. Brit. Mus., vi., p. 1332, no. 1 (1855).

This, an exceedingly scarce moth, is only known to me by Geyer's figures of the female, one of which is copied on our plate. It measures nearly three inches across the wings, which, as well as the body, are black, thickly dusted with white, the moderately pectinated antennæ, abdomen, and under surface of the wings inclining to reddish-brown. There is a slender white collar in front of the thorax, and the body is moderately stout, and nearly as long as the hind-wings. The

fringes of the wings are ochre-yellow between the black nervures. The fore-wings are broad and sub-triangular, with the costa nearly straight, and the hind margin gradually curved. The hind-wings are nearly as long as the fore-wings, and the hind margin is rounded. The fore-wings are crossed by two large white lunules before the middle, preceded by a round white dot on the costa, and succeeded by another on the inner margin. The ocellus is formed of a white, curved, and irregularly shaped mark, surrounded with black and orange. Beyond the ocellus is a curved row of white semi-circular spots, the bases of which are outward, and are stained with yellow. The spot nearest the inner margin is small, but those next to it are considerably larger than the upper ones. This white band is more continuous on the hind-wings, running round a large black central ocellus, containing a white curve surrounded with orange. The white on the inner side of the black spot is interrupted by a yellow dash, and the space between this and the base is bright pink or rosy; within the white band is an oval black spot on the inner margin. The outside of this white band is stained with buff. On the under side the eye-spots are much smaller, and there is a row of white sub-costal spots on the fore-wings, those near the base stained with pink, a large rosy blotch filling up the whole of the inner part of the wing, except towards the base and costa. On the hind-wings there is only a slight rosy patch towards the base of the inner margin.

GENUS AUTOMERIS.

Automeris, Hübner, Verz. bek. Schmett., p. 154 (1822?).

Hyperchiria, pt. Walker (nec Hübner), List Lepid. Ins. Brit.

Mus., vi., p. 1277 (1855).

Io, pt. Boisduval, Ann. Soc. Ent. Belg., xviii., p. 188 (1875).



1. *Automeris io*.
 2. *Hemileuca maia*.
 3. do do, larva.

This genus and its allies are very numerous in America, though very few are met with north of the Tropics. The wings are generally short and broad, rarely hooked, or considerably dentated or subcaudate, and there is usually a large round opaque eye-spot on the hind-wings only. The round black spot which usually occupies the centre is sometimes irregularly marked with white, or with some shade of grey.

The larva is set with tufts of urticating prickles, and the cocoon is formed between leaves.

THE IO MOTH. AUTOMERIS IO.

(Plate CXXII., Fig. 1.)

Bombyx io, Fabricius, Syst. Ent., p. 560, no. 16 (1775).

Lasiocampa io, Peale, Lepid. Amer. pl. 6 (1833).

Aglia io, Duncan in Jardine's Nat. Libr., Exot. Moths, p. 156, pl. 16, fig. 3 (1841).

Hyperchiria varia, Walker, List Lepid. Ins. Brit. Mus. vi., p. 1278, no. 1 (1855).

Io fabricii, Boisduval, Ann. Soc. Ent. Belg., xviii., p. 223 (1875).

The Io Moth is a common North American species. The male expands two inches and a half, the female being somewhat larger.

The antennæ are yellow, as are also the head and thorax, which are hairy. The fore-wings are yellow in the male, with several waved, brown streaks; they are reddish-brown in the female, with three waved yellow lines, and several yellow streaks placed close together near the centre. The hind-wings are yellow, with a large black ocellus with an elongated white centre. Beyond this ocellus is a semi-circular black band, and beyond this, and parallel with it, is a ferruginous band which is continued to the inner margin, which is also ferruginous.

The under side is yellow, with a black discal spot on the forewings, centred with white, beyond which is a reddish transverse streak, and a transverse ferruginous streak on the hind-wings.

The larva feeds on a number of plants, including Indian corn, Sassafras, Dogwort, and Poplar. It is somewhat stout and fleshy, light green, with a reddish-brown and white stripe on the sides, extending from the fourth segment to the extremity of the body. Each segment has five or six tufts of green prickles, terminated by minute black points which prick the hand if touched, causing severe smarting. The pupa is dark brown, approaching black, and is enclosed in a cocoon between leaves.

Abbot found the larva to spin up on September 27, and the first moths appeared on the wing on May 17, and others continued to emerge at different times till August 15 following. When young, the larvæ feed in large companies, but afterwards become solitary.

GENUS HEMILEUCA.

Hemileuca, Walker, List Lepid. Ins. Brit. Mus. vi., p. 1317 (1855).

This is another American genus of moderate-sized species; but, unlike the last, the species are more numerous in North than in South America, especially in the Western States. The body is downy, and the wings are moderately long and broad, and rounded at the tips. They are opaque, and there is a crescent-shaped spot in the middle of each.

HEMILEUCA MAIA.

(Plate CXXII., Fig. 2; Fig. 3, larva.)

Attacus maja, Drury, Ill. Exot. Ent., ii., pl. 24, fig. 3 (1773);
Cramer, Pap. Exot., ii., pl. 98, fig. A (1777).

Bombyx proserpina, Fabricius, Syst. Ent., p. 561 (1775).

Attacus proserpina, Abbot & Smith, Lepid. Georg., ii., pl. 50 (1797).

Saturnia maia, Duncan in Jardine's Nat. Libr., Exot. Moths, p. 154, pl. 16, fig. 1 (1841).

This species is the most widely distributed of the genus in North America. It expands about two inches and a half. The head and antennæ are black, the latter strongly pectinated. The wings are black, rather delicate in texture, and translucent, with a broad whitish band, which is broadest on the hind-wings. On each of the wings is a black spot on the white band containing a whitish streak. That of the fore-wings is situated on the inner side of the band, whilst that on the hind-wings is placed in the centre of the band. The thorax is black, whitish in front, and the abdomen is black, terminated by an orange tuft in the male; and with white spots on the sides beneath. The under side of the wings is similar to the upper, and the abdomen is grey beneath. The legs are black, with orange-coloured femora.

The larva feeds on various species of oak, especially the red oak (*Quercus rubra*). It varies considerably in colour, according to its age. When full-grown it is yellow, with a broad, dark stripe on each side, and two reddish tubercles on the back of each segment. The head, last segment, and legs are purplish-red. Each segment has several hairy spines.

Abbot says that this moth is called in America the Buck-fly, from an erroneous popular idea that bucks breed its larvæ in their heads and blow them out of their nostrils. No doubt this notion has arisen by the larvæ being confounded with Dipterous parasites. It happens that the moth comes out in the rutting season whilst the bucks are pursuing the does. The hunters, therefore, take notice of the insect so as to know

the proper time for their sport, which is later in Georgia than in Virginia, as is also the appearance of the moth, which is much more abundant in the latter State than in the former. One of the larvæ in Virginia went into the ground on July 1st and the moth emerged on October 20th. In Georgia the same species buried itself on June 14th and the moth did not appear till December 8th, after which other individuals kept coming out till February 16th.

The male flies in the daytime, swiftly rising and descending.

The larva stings very sharply. When young they feed gregariously, but they disperse when they become large.

FAMILY XXXIII. LASIOCAMPIDÆ.

Egg.—Large, smooth, and glossy.

Larva.—Thickly clothed with hair, and sometimes with humps on the front of the body.

Pupa.—Enclosed in a firm oval cocoon, whence some of these moths are called Eggars.

Imago.—Of large or moderate size, and generally of some shade of brown, and with no ocellated spots on the wings. Proboscis inconspicuous; palpi porrected, large or small; antennæ strongly bipectinated, at least in the males; cells of the wings closed; hind-wings without frenulum, and with two sub-median nervures; hind tibiæ usually with small terminal spurs.

Habits.—The males of many of the species of this family fly very rapidly by day, but can often be attracted from a considerable distance by the presence of a female freshly emerged from the cocoon.

GENUS PACHYPASA.

Pachypasa, Walker, List Lepid. Ins. Brit. Mus. vi., p. 1422 (1855).

Body very stout, extending considerably beyond the hind-wings; head prominent, palpi stout, pilose, longer than the head; antennæ in the male very broadly pectinated, less so towards the tip. Wings densely scaled, long, rather narrow, and rounded.

The type of this genus is a large moth, which is very unlike any other European species.

PACHYPASA OTUS.

Sphinx otus, Drury, Ill. Exot. Ent. i., pl. 16, fig. 3 (1773).

Bombyx dryophaga, Geyer in Hübner's Eur. Schmett., iii., figs. 366, 367 (1828?).

Lasiocampa otus, Boisduval, Icones, ii., p. 163, pl. 65, fig. 1 (1834); Kirby, Eur. Butterflies and Moths, p. 129, pl. 53, fig. 2 (1880).

Gastropacha dryophaga, Treitschke, Schmett. Eur., x. (i.), p. 185 (1834); Herrich-Schäffer, Schmett. Eur., ii., p. 104, no. 6, figs. 23, 24 (1844).

This large moth is found in Southern Europe and Western Asia. It expands about four inches and a half.

The head and antennæ are reddish-brown, the latter closely and strongly pectinated at the base in the male, and tapering to the tip. The wings are long and narrow, entire, and of a brown colour. The fore-wings are traversed by two zig-zag black transverse lines, and the surface is dusted with coarse black atoms, but the area between the transverse lines remains paler than the rest. The hind-wings are brown, with two indistinct curved lines.

The female is larger than the male, with slightly serrated antennæ.

The larva is light or dark brown, with brownish-grey stripes. On the third and fourth segments are two deep orange-coloured humps, varied with black. On the rest of the back is a longitudinal row of connected yellowish spots, edged with darker. On the head and on both sides, near the legs, are prominent, yellowish-brown tufts of hair, placed on white tubercles.

The pupa is brown, and is enclosed in a dense, silky white or light grey oval cocoon.

The moth appears in July and August.

Unless my memory fails me, I have somewhere seen it suggested that the famous Coan silk may have been obtained from this insect.

GENUS PHILHYDORIA.

Odonestis (nec Germar), Stephens, Ill. Brit. Ent. Haust. ii., p. 51 (1828).

Odenestis, Walker, List Lepid. Heter. Brit. Mus. vi., p. 1409 (1855).

Philudoria, Kirby, Cat. Lepid. Heter. i., p. 820 (1892).

The genus *Odonestis* of Germar was formed to include two species, *Bombyx pruni* and *B. potatoria* of Linnæus. As, however, the latter was placed in it with doubt, it follows necessarily that *B. pruni* (a reddish-brown Continental species, with dentated wings, and a white spot in the middle of each fore-wing) must be regarded as the type of *Odonestis*.

In *Philhydoria* the antennæ are long, and strongly pectinated in the males; and the palpi are long and stout, forming a beak. The hind margin of the hind-wings is slightly waved, and the abdomen is tufted in the male. The sexes are very dissimilar.

THE DRINKER MOTH. PHILHYDORIA POTATORIA.

(Plate CXXIII., Figs. 1, 2.)

Bombyx potatoria, Linnæus, Syst. Nat. (ed. x.) i., p. 498, no. 11 (1758); Esper, Schmett., iii., p. 75, Taf. 11 (1782); Hübner, Eur. Schmett. iii., figs. 182, 183 (1804 ?); Godart, Lépid. France, iv., p. 92, pl. 8, figs. 3, 4 (1822).

Gastropacha potatoria, Ochsenheimer, Schmett. Eur., iii., p. 256 (1810).

Odonestis potatoria, Stephens, Ill. Brit. Ent. Haust., ii., p. 51 (1828); Buckler, Larvæ of Brit. Lepid., iii., p. 60, pl. 50, figs. 3, 3 a, b (1889); Barrett, Lepid. Brit. Isl., iii., p. 37, pl. 94 (1895).

Lasiocampa potatoria, Kirby, Eur. Butterflies and Moths, p. 129, pl. 28, figs. 4, 4 a-c (1880).

The Drinker Moth is found throughout Europe and Northern Asia. It expands from two to two and a half inches, the female being considerably larger than the male.

The antennæ are brownish in the male, and strongly pectinated. The head and thorax are brown, and the abdomen brownish-yellow. The fore-wings are obtusely pointed, brownish-yellow shaded with darker, with a rusty brown, somewhat curved, transverse line near the base. From the apex an almost straight line, bounded on the outer side with lighter, runs obliquely to the inner margin, and in front of the hind margin is a dark brown zig-zag line. In the centre is a whitish or yellowish, elongated, oval, or reniform, spot, surmounted by a dot of the same colour. The hind-wings are coppery brown, with an indistinct dark band.

The female is yellowish, though ochre-brown varieties are occasionally met with. The markings are similar to those of the male.

The larva hibernates, and may be found full-grown in May

and June on various species of grass. It is dark brown with short hairs; striped with yellow on the sides, and tufted with white. On the third and twelfth segments is a black pointed tuft of hair.

The pupa is dark brown. The cocoon is soft but dense, and interwoven with hairs.

The moth emerges after three or four weeks. It is common in many places, and is easily reared from the larva.

GENUS DENDROLIMUS.

Dendrolimus, Germar, Syst. Gloss. Prodr., p. 48 (1812); Curtis, Brit. Ent., i., pl. 9 (1824).

Eutricha, Stephens (nec Hübner), Ill. Brit. Ent. Haust., ii., p. 50 (1828); Walker, List Lepid. Ins. Brit. Mus., vi., p. 1405 (1855).

Æona, Walker, op. cit., p. 1417 (1855).

In this genus the wings are long and rather broad, with the hind margins almost entire; the palpi are long, pilose, and beak-like, and the body is stout, the abdomen extending a little beyond the hind-wings.

This is a rather extensive genus, which has representatives in most parts of the world, but is most numerous in the East Indies. One species only is found in Europe.

THE PINE LAPPET. DENDROLIMUS PINI.

Bombyx pini, Linnæus, Syst. Nat. (ed. x.), p. 498, no. 12 (1758); id., Faun. Suec., p. 292 (1761); Esper, Schmett., iii., p. 78, Taf. 12, 13 (1782); Hübner, Eur. Schmett. iii., figs. 184, 185 (1804?); Godart, Lépid. France, iv., p. 90, pl. 8, fig. 2 (1822).

Gastropacha pini, Ochsenheimer, Schmett. Eur., iii., p. 251 (1810?); Herrich-Schäffer, Schmett. Eur., ii, p. 104. no. 10, fig. 25 (1844).

Odonestis pini, Curtis, Brit. Ent., i., pl. 7 (1824).

Eutricha pini, Stephens, Ill. Brit. Ent. Haust. ii., p. 50 (1828).

Lasiocampa pini, Kirby, Eur. Butterflies and Moths, p. 129, pl. 28, figs. 3 a-c (1880).

The Pine Lappet is found throughout the greater part of Europe and Northern Asia. It expands about two inches and a half.

The antennæ are brown, whitish at the base, and strongly pectinated in the male. The head and thorax are coloured like the fore-wings, and the abdomen like the hind-wings.

The wings are slightly denticulated. The fore-wings are brown, dusted with light grey. At the base a rust-coloured spot, and in the middle a small white spot, usually triangular in shape. There is a broad rust-coloured transverse band, running parallel with the hind margin, and bounded by dark brown zig-zag lines, of which frequently only the outer one is distinctly defined. The hind-wings are of a uniform rust-colour. The under side is greyish-brown, sometimes with dark transverse bands. Numerous varieties occur, and hardly any two specimens are exactly alike.

The larva, which is in some years very destructive on the Continent, feeds on fir and pine. It hybernates in various stages of growth under moss, and is full-grown at the beginning of July.

It is usually silvery or ashy grey on the back, with red hairs and brown diamond-shaped spots. On the sides is an interrupted brown stripe. On the third and fourth segments is a dark blue, transversely placed stripe, and on the last an obtuse tuft. The sides are set with long hairs arranged in tufts.

The pupa is dark brown, with reddish-brown incisions, and is placed in a dense, elongated cocoon of a yellowish-grey colour, mixed with darker hairs. The perfect insect emerges after three or four weeks.

Although this moth is abundant on the Continent, it is very doubtful whether the few specimens obtained in England were really indigenous.

GENUS GASTROPACIIA.

Gastropacha, Ochsenheimer, Schmett. Eur., iii. p. 239 (1810); Stephens, Ill. Brit. Ent. Haust. ii., p. 52 (1828); Walker, List Lepid. Ins. Brit. Mus., vi., p. 1388 (1855).
Eutricha, Hübner, Tentamen, p. 1 (1810?).

This is a genus of stout-bodied moths, with strongly pectinated antennæ, and the abdomen extending a little beyond the hind-wings. The palpi are stout, pilose, and beak-like. The wings are strongly dentated, and the hind-wings are so broad that they project considerably in front, from beneath the fore-wings, when the latter are folded over them while the insect is resting.

THE LAPPET MOTH. GASTROPACHA QUERCIFOLIA.

(Plate CXXVIII., Fig. 3; larva, Fig. 4.)

Bombyx quercifolia, Linnæus, Syst. Nat. (ed. x.), i., p. 497, no. 8 (1758); id., Faun. Suec., p. 293 (1761); Esper, Schmett., iii., p. 56, Taf. vi., figs. 3-7; Taf. 6 A, figs. 1, 2 (1782); Hübner, Eur. Schmett., iii., figs. 187, 188 (1804?); Godart, Lépid. France, iv., p. 76, pl. 7, figs. 1, 2 (1822).

Gastropacha quercifolia, Ochsenheimer, Schmett. Eur., iii., p. 247 (1810); Stephens, Ill. Brit. Ent. Haust., iii., p. 52 (1828); Kirby, Eur. Butterflies and Moths, p. 128, pl. 28, figs. 1 a-c (1880); Buckler, Larvæ of Brit. Lepid., iii., pl. 51, figs. 1, 1 a, b (1889); Barrett, Lepid. Brit. Isl. iii. p. 42, pl. 95 (1895).

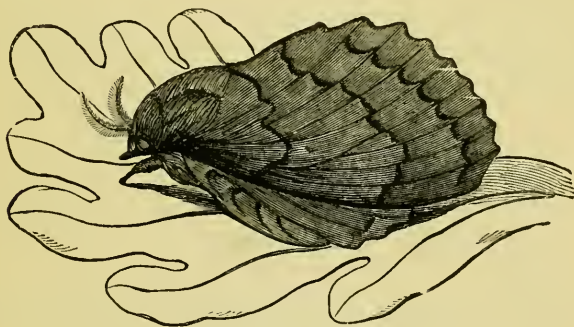


1. 2. *Philhydonia potatoria* ♂ ♀

3. *Gastropacha quercifolia*.

4. do do larva.

The Lappet Moth has a wide range, extending throughout Europe, as well as Northern and Western Asia. It has an expanse of from two inches and a quarter to three inches and a quarter across the wings. The antennæ are blackish on the outer, and red on the inner side. The head and thorax are rust-colour, without markings, and the abdomen is rusty brown. The wings are very strongly dentated, and the fore-wings are light rust-coloured, dusted with yellowish-grey on the costa, suffused with purplish towards the hind margin, and with the



Lappet Moth.

inner margin rusty yellow. In the middle is a small oval black spot placed between two blackish transverse lines; of these, that near the base is waved, whilst the other curves inwards from the costa, and is continued in a series of slightly connected small curves obliquely to the inner margin. A third line, less distinct than the others, runs near the hind margin, and consists of blackish lunules, with the concave side directed outwards. The hind margin is yellowish, and the teeth on it black. The hind-wings are rusty yellow on the costa, shaded with blackish in the middle, and crossed by two simple transverse lines; the hind margin is suffused with purplish.

The larva hibernates when young, and is full-grown in May and June. It feeds on various trees, such as sloe, rose, and willow. It is ashy-grey or light brown, with broad, dark blue, bands on the incisions between the second and fourth segments, and a tufted elevation on the penultimate segment. On the sides, above the legs, is a row of warts, bearing tufts of long hairs, and there are two brown tubercles on each segment. The pupa is dark brown, and is enclosed in a dense, oval, dark grey cocoon, dusted with white, giving the pupa within a bluish appearance.

The curious position of the moth in repose will be seen in our woodcut. The moth is not very rare in England, but is seldom really common.

GENUS LASIOCAMPA.

Bombyx, pt. Linnæus, Syst. Nat. (ed. x.), i., p. 496 (1758); Boisduval, Ind. Meth. p. 48 (1829); id. Gen. Ind. Meth., p. 69 (1840).

Lasiocampa, Schrank, Fauna Boica, ii. (2), pp. 147, 154 (1802); Stephens, Ill. Brit. Ent. Haust. ii. p. 38 (1828); Walker, List Lepid. Ins. Brit. Mus., vi. p. 1427 (1855).

Lasiocampa includes rather large moths, with strongly pectinated antennæ in the males, and short palpi. The abdomen is moderately stout, and hardly extends beyond the hind-wings. The wings are moderately long, and not dentated, the hind margin of the fore-wings is but slightly oblique, and the hind-wings are not much shorter than the fore-wings. The hind tibiæ are armed with two small apical spurs.

As mentioned under *Bombycidae*, Boisduval and some later writers have misapplied the name *Bombyx*, which properly belongs to the silkworm, to this genus. The name *Lasiocampa* means "hairy larva."

THE OAK EGGAR. LASIOCAMPA QUERCUS.

Bombyx quercus, Linnæus, Syst. Nat. (ed. x.), i. p. 498, no. 13 (1758); id. Faun. Suec., p. 293 (1761); Esper, Schmett. iii., p. 81, Taf. 14, figs. 1, 2 (1782); Hübner, Eur. Schmett. iii., figs. 172, 225, 349, 350 (1804?); Godart, Lépid. France, iv., p. 95, pl. 9, figs. 1, 2 (1822).

Gastropacha quercus, Ochsenheimer, Schmett. Eur. iii., p. 266 (1810).

Lasiocampa quercus, Stephens, Ill. Brit. Ent. Haust., ii. p. 40 (1828); Kirby, Eur. Butterflies and Moths, p. 139, pl. 29, figs. 1 a-e (1880); Buckler, Larvæ of Brit. Lepid. iii., p. 56, pl. 47, figs. 2, 2 a, b (1889); Barrett, Lepid. Brit. Isl. iii., p. 25, pl. 91 (1895).

Bombyx familiaris, Newman, Zool. vii., p. 27 (1849).

Var. *Lasiocampa callunæ*.

Bombyx quercus, pt. Linnæus (vide *suprà*.)

Lasiocampa roboris, Stephens (nec Schrank), Ill. Brit. Ent. Haust. ii., p. 41 (1828).

Lasiocampa callunæ, Palmer, Zool. v. p. 1656 (1847).

Bombyx callunæ, Guenée, Ann. Soc. Ent. France (3), vi. p. 442, pl. 10, fig. 3 (1858).

Lasiocampa quercus, var. *callunæ*, Buckler, *op. cit.*, p. 58, pl. 47, figs. 3, 3 a, d (1889); Barrett, *op. cit.*, p. 27, pl. 92 (1895).

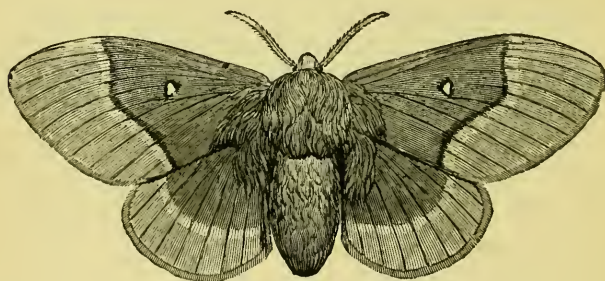
Var. *Lasiocampa roboris*.

Bombyx quercus, Esper, Schmett. iii., p. 81, Taf. 13, figs. 2-6 (1782); Hübner, Eur. Schmett. iii. fig. 270 (1804?)

Bombyx roboris, Schrank, Fauna Boica, ii. (i.), p. 275 (1801).

The Oak Eggar is common throughout Europe and Northern and Western Asia. The male expands about two inches and a half, and the female about three inches.

The male is of a deep chestnut-brown with an ochre-yellow band running across all the wings beyond the middle. This band is clearly defined on the inner side, but becomes hazy externally, where it runs into and blends with chestnut-colour. On the fore-wings is a small white, nearly triangular, central spot placed in a dusky ring and a yellowish patch at the



Oak Eggar. Female.

base. The border of the fore-wings is narrow and brown, and that of the hind wings is broad and ochreous, and occasionally clouded with brown. The body is of the same colour as the dark portion of the wings, and ochre-yellow beneath, and the legs are also ochreous. The antennæ are chestnut-brown.

The female is generally larger than the male; the markings are similar, but the body and wings are ochre-yellow, with the central band paler, and the white spot on the fore-wings larger than in the male.

This insect varies considerably in colour, but is easily recognisable, and the various named varieties hardly require detailed notice.

The larva is found in the autumn, and after hibernating continues to feed till the June of the following year on oak, willow, hawthorn, broom, birch, and various other trees and shrubs. It is yellowish, covered with greyish-brown hairs, with black incisions, and a white macular band on the sides. There is also an interrupted row of white spots on the back, and a pale yellow mark on the front of the head.

Like the perfect insect, the larva is subject to considerable variation. The pupa is brown, with lighter incisions, and blackish wing-cases, and is contained in a brownish-grey cocoon.

The male moth flies by day with great rapidity, over heaths and in woods, but may easily be lured within reach by the presence of a female newly emerged from the pupa.

The Fox Moth (*Macrothylacia rubi*, Linn.) has shorter and redder wings than *Lasiocampa quercus*, with two white transverse lines on the fore-wings. The larva, which feeds on heath and bramble, is black, with golden-brown hair. The hairs are very brittle, and the broken ends, if accidentally transferred to the eyes, have been known to cause blindness from irritation.

GENUS CLISIOCAMPA.

Clisiocampa, Curtis, Brit. Ent. v., pl. 229 (1828); Stephens, Ill. Brit. Ent. Haust. ii., p. 48 (1828); Walker, List Lepid. Ins. Brit. Mus. vi., p. 1485 (1855)

Clisiocampa includes rather small species, with short palpi, and less strongly pectinated antennæ than *Lasiocampa*. The wings are entire, and are longer and narrower than in *Lasiocampa*, the hind margin of the fore-wings being more oblique, and there is no white discoidal spot. The moths lay their eggs in a bracelet round the twigs of the tree on which the larvæ are

to feed; and the larvæ are adorned with a beautifully variegated pattern, which has led to the insects being called Lackey Moths.

THE LACKEY MOTH. CLISIOCAMPA NEUSTRIA.

Bombyx neustria, Linnæus, Syst. Nat. (ed. x.), i., p. 500, no. 19 (1758); id. Faun. Suec., p. 292 (1761); Esper, Schmett., iii., p. 143, Taf. 27 (1785); Hübner, Eur. Schmett., iii., figs. 179, 180 (1800?).

Gastropacha neustria, Ochsenheimer, Schmett. Eur., iii., p. 296 (1810).

Clisiocampa neustria, Stephens, Ill. Brit. Ent. Haust. ii. p. 49 (1828); Kirby, Eur. Butterflies and Moths, p. 131, pl. 28, figs. 6 a, b (1880); Buckler, Larvæ of Brit. Lepid., iii., pl. 50, figs. 2, 2 a (1889); Barrett, Lepid. Brit. Isl., iii., p. 13, pl. 88 (1895).

The Lackey Moth is common throughout Europe, as well as in Northern and Western Asia.

It expands from one inch and a quarter to one inch and a half.

The antennæ, body, and wings are all of a uniform colour, varying from pale ochre-yellow to deep reddish-brown.

Across the fore-wings run two reddish-brown, or, in the darker specimens, yellowish, transverse lines, the first of which is almost straight, and the second rather curved. The space between the lines is sometimes of a darker colour, thus forming a band, and the hind-wings are frequently crossed by a faint dark transverse stripe. The fringes are unequally chequered with lighter and darker. The under side is like the upper, with a dark, band-like shade through the middle.

The larva, which is very abundant in some years, is found from the end of April to the beginning of June on all kinds of fruit-trees, as well as on oak, poplar, whitethorn, sloe, &c. It is

elongated, with soft fine hairs. It is striped with blue, red, and yellow, and has a white dorsal line. The head is bluish-grey, with two black dots. The larvæ, which are gregarious, live under a web when young, and are often very destructive.

FAMILY XXXIV. MEGALOPYGIDÆ.

This is a small family of American moths, which have a general resemblance to the genus *Cerura*, in the *Notodontidæ*, having grey or whitish wings, with dark transverse lines. They are, however, very distinct. The wings are broad and rounded, and are clothed not only with scales, but towards the base, and in lines on the wings, with long curled hairs. There are three sub-median nervures on each wing, the two lower ones on the fore-wings anastomosing a short distance from their base, and then again separating. The bodies of these moths are very hairy, and there is a very large terminal tuft of white or yellow hair in the females. The cells are bisected by nervures, especially on the hind-wings. The transformations are also remarkable, the larvæ having twenty legs, like those of some saw-flies, the largest number in most Lepidopterous larvæ being sixteen, and the first two segments of the abdomen (except in the *Megalopygidæ* and *Micropterygidæ*) destitute of pro-legs. The cocoon of the *Megalopygidæ* is provided with a trap-door at one end, another character which reminds us of the saw-flies.

FAMILY XXXV. EUPTEROTIDÆ.

Under this name Sir George Hampson has separated a number of moths formerly included in the *Lasiocampidæ*, but distinguished by the possession of a frenulum. The palpi are short and hairy, the middle tibiæ are usually armed with one pair of spurs, and the hind tibiæ with two. The wings are

usually shorter and broader than in the *Lasiocampidæ*, and the body is frequently comparatively slender. Most of the genera are Indian or African. The following is European :—

GENUS THAUMETOPŒA.

Thaumetopœa, Hübner, Verz. bek. Schmett., p. 185 (1822 ?).
Cnethocampa, Stephens, Ill. Brit. Ent. Haust. ii., p. 46 (1828);
 Walker, List Lepid. Ins. Brit. Mus., v., p. 1039 (1855).

These are rather small and very hairy moths, with a tuft at the end of the abdomen. The antennæ are bi-pectinated, and the middle and hind tibiæ are armed with two small apical spurs. The larvæ are gregarious, and their hairs and the dust from their nests are more strongly urticating than those of any other European genus.

This genus is sometimes referred to the *Notodontidæ*.

THE PROCESSIONARY MOTH. THAUMETOPŒA PROCESSIONEA.

Bombyx processionea, Linnæus, Syst. Nat. (ed. x.), i., p. 500, no. 21 (1758); (ed. xii.), i. (2), p. 819, no. 37 (1767);
 Esper, Schmett. iii., p. 150, Taf. 29, figs. 1–5 (1785);
 Hübner, Eur. Schmett. iii., figs. 159, 160 (1800 ?);
 Godart, Lépid. France, iv., p. 126, pl. 12, figs. 5, 6 (1822).

Gastropacha processionea, Ochsenheimer, Schmett. Eur. iii., p. 280 (1810).

Cnethocampa processionea, Stephens, Ill. Brit. Ent. Haust. ii., p. 47, note (1828); Kirby, Eur. Butterflies and Moths, p. 133, pl. 24, figs. 7 a, b (1880).

This moth is found throughout nearly the whole of Europe, but, though common on the Continent, and often very destructive to the trees, it is not a British species.

It expands about an inch or a little more.

The antennæ are light brown, the head and thorax ashy-grey, and the abdomen brownish, with a dark brown anal tuft. The fore-wings are ashy grey, clouded with darker. At the base is a dark grey transverse line, and another similar one just beyond it, running obliquely across the wings. A third rather undulating line runs beyond the middle, and approaches the second at the inner margin. Between these two lines is usually a blackish dot. The hind-wings are whitish, with a faint dark grey transverse line, which is sometimes slightly thickened at the inner margin. The fringes of all the wings are chequered with light and dark grey. The under side is whitish grey, with the markings of the upper side scarcely indicated. The female is larger than the male, and has usually two indistinct dusky bands on the fore-wings, with a dark dot between them.

The larva feeds on oak from May to the beginning of July. It is covered with light grey hair, and is bluish-black on the back, and whitish on the sides, with two orange or pale grey hairy warts on each segment.

The larvæ live gregariously under a web, and are remarkable for their carefully arranged migrations, which are conducted by travelling in file or procession. Their destructiveness, and the inflammation set up by the hairs on the human skin, cause them to be much dreaded in some places.

The pupa, which is ochre-yellow, with two short spikes at the posterior extremity, is enclosed in a dense, reddish-brown cocoon, with interwoven hairs. The moth may appear in about five weeks, or not till the following year.

FAMILY XXXVI. PINARIDÆ.

In this family I include several Indian, African, and Australian genera usually placed in the *Lasiocampidæ*, but which differ greatly in the size and structure of the sexes. In the males, the fore-wings are long, pointed, and triangular, the hind margin being very oblique and the hind-wings small and rounded. The antennæ are long, and strongly pectinated, sometimes throughout, while sometimes the pectinations become much shorter beyond the middle. The abdomen is long, comparatively slender, and tapering, and extends much beyond the hind-wings. The females, on the contrary, are stout-bodied moths with the wings much broader and more rounded than in the males; the antennæ are shorter than in the male, and slightly, if at all, pectinated. The palpi in both sexes are pilose and rather prominent, with the third joint short. The larvæ have tufts of very long hairs on the sides, those on the front segments being longest, and directed forwards, and there are frequently two transverse round hairy prominences on the anterior segments.

GENUS ANDRAPHISIA.

This genus is allied to *Gonometa*, of Walker, the type of which is *G. postica*, Walker, from Natal; but it differs in the longer and more pointed wings in both sexes, and in the long sub-caudate and dentated wings of the male. The sexes differ greatly in appearance in this, as in all the genera of this family, but they agree in being very pilose, and in having very broad laterally compressed palpi with a long second and short terminal joint. In the male, the antennæ are very strongly pectinated, but become suddenly filiform towards the tip. The abdomen is long, and extends for half its length beyond the hind-wings, and appears to be of equal breadth nearly to the tip, but

terminates in a central pointed tuft of hairs, which is rather longer than the terminal lateral tufts. The fore-wings resemble those of a *Chærocampa* or a *Cucullia* in shape, being acutely pointed, with the costa somewhat convex for the last three-quarters of its length, and the hind margin scalloped between the nervures. The hind-wings are of a very peculiar shape, the hind margin being scalloped between the nervures, and produced into a short tail at the outer angle, and beyond this point the margin runs straight and obliquely inwards to the anal angle, which is not well marked, owing to the inner margin being fringed with long hairs. The clothing of the wings is very thick, and as the specimens cannot be denuded, the neuration is a little difficult to follow, but the cells appear to be open, the median nervure four-branched, and the sub-costal nervure of the fore-wings five-branched, the branches being very long. In the female, the antennæ are longer than in *Gonometa*, and are shortly and regularly pectinated, the thorax is crested on the median line, and the abdomen is tufted on the sides. The abdomen, though stout, is less so than in the female of *Gonometa*, and though longer and more tapering, hardly extends beyond the hind-wings, because the latter are much longer than in *Gonometa*. The fore-wings are leaf-shaped, and very broad before the apex, which is pointed; the costa is much arched before the extremity, and the hinder angle is convexly rounded off. The hind-wings are likewise regularly rounded, and as in the fore-wings, the hind margins are hardly scalloped. The neuration resembles that of the male, but the cells in all the wings are closed and the sub-costal nervure of the fore-wings is six-branched.

We are indebted to His Excellency Sir Gilbert Carter for the discovery of the transformations of the interesting species upon which I have founded the present genus. He forwarded both sexes to Miss Emily Mary Sharpe, who has kindly lent

them to me, and her description of the male, and Sir G. Carter's notes on the transformations are here reproduced; his specimens of both sexes are figured, as the typical specimen of *A. subfascia* (Walker) is considerably rubbed. The synonym of *G. lomia* is added on the authority of Mr. H. Druce himself.

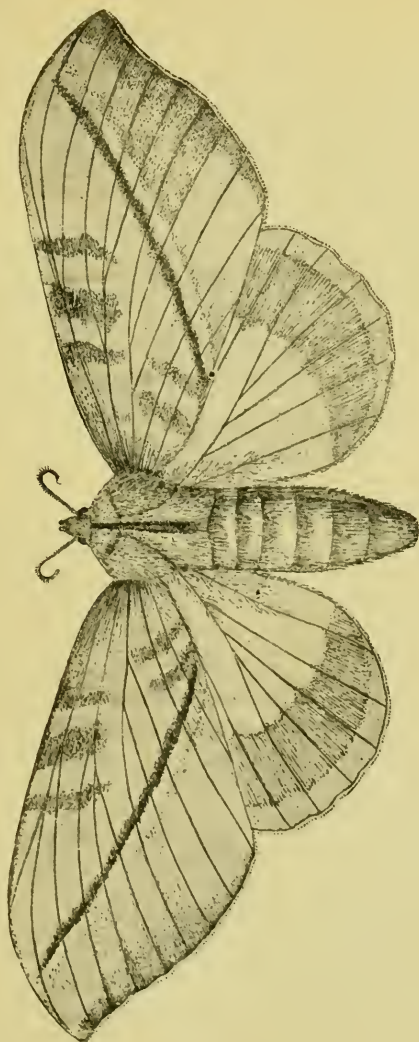
ANDRAPHISIA SUBFASCIATA.

- ♀ *Pachypasa subfascia*, Walker, List Lepid. Ins. Brit. Mus. vi. p. 1426, no. 4 (1855); Dewitz, Verh. Leop.-Carol. Acad. xlii., p. 72, pl. 2, fig. 12 (1881).
 ♂ *Gonometa lomia*, Druce, Proc. Zool. Soc. Lond. 1887, p. 681 (1888).
 ♀ *Gonometa subfascia*, Kirby, Syn. Cat. Lepid. Heter. i., p. 856, no. 3 (1892).



Andraphisia subfasciata. Male.

The head of the female is light grey; the antennæ yellowish-grey on the basal half, and black beyond the middle; the palpi, the sides of the head, and the whole under surface of the body are dark brown, the tip of the palpi being tawny. The thorax is buff, rather darker on the central ridge and behind; the first



Andraphisia subsfasciata. Female.

four segments of the abdomen are whitish on the sides, and slightly tinged with tawny above ; the terminal segments of the abdomen are tawny, and the first tawny segment and the two preceeding segments bear tufts on the lower part of the sides, which are brown below and tawny above.

The fore-wings are light brown, darker on the margins, and with a brown stripe running obliquely from about two-fifths of the length of the inner margin to three-fourths of the length of the costa ; above this are two faint whitish markings, bordered indistinctly with brown before and behind ; one about the middle of the costa, and the other towards the inner margin, just within the stripe. The hind-wings are greyish-white, with a broad greyish-brown border, shading into dull tawny on the hind margin.

The following is Sir Gilbert Carter's account of this insect:—"I have been able to secure specimens of the eggs, young, and adult caterpillar and sexes of this moth. I also send examples of the ♂ and ♀ cocoon. The caterpillar feeds upon the Avocado pear (*Persea gratissima*) the Flamboyant (*Tonciana regia*), and the Eucalyptus, which you will admit is a varied assortment. In its more advanced stages it so successfully mimics the colouring, and lies so close to the twigs of the tree upon which it feeds, that it is very difficult to see. There have been great numbers about this season. I am wondering whether the silk has ever been put to economical use. Perhaps you can tell me? It is probable that the history of this interesting creature has not been so thoroughly worked out before. If this is so, you will, no doubt, make use of these notes. The male possibly is not known, and had I not had my specimens and been in possession of other evidence as to identity of the sexes, I certainly should not have paired the specimens I send you."

The following observations are from the pen of Miss

Sharpe: "The male differs very much from the female in colour, the fore-wings being much more pointed and the hind-wings more angulated. The colour of the hind-wing is almost entirely brown, inclining to pinkish on the costal and hinder aspects, with a sub-terminal line of black near the hind margin, and with a second obscure line of black crossing the middle of the wing. The costal portion of the fore-wing, including the discoidal cell, is of a pale sandy brown, the nervules being indicated by lighter buff, brought into relief by accompanying lines of black which form two somewhat distinct spots towards the apex of the wing. The discal portion of the wing is traversed by a band of reddish-brown, extending from the base to the costal margin, and separated continuously from the lighter costal portion of the wing by some black spots, which form a row, but are not very distinct. The discal nervules are marked by a black line, and a somewhat distinct band of black traverses the wing in the lower portion of the disc, following the line of the inner and hind margins, both the latter being marked with velvety black, traversed by alternate markings of buff. The head and thorax are dark reddish-brown, the body being much lighter. The under side is reddish-brown, the hind margin being distinctly marked with dark brown.

"Expanse of male, 2.9 inches; of female, 5 inches; caterpillar, $3\frac{3}{4}$ inches long.

"The male makes a different cocoon to that of the female, the former spinning up inside a leaf of which the two edges are almost united, the cocoon of the female being of the ordinary Bombyciform type."

It is to be regretted that Sir Gilbert Carter has not forwarded a detailed description of the larva of this interesting moth. A specimen in spirit shows it to be furnished with tufts of long shaggy yellowish (?) hair on the sides, and clusters of short diverging black spines on the back.

GENUS SUANA.

Suana, Walker, List Lepid. Ins. Brit. Mus. vi. p. 1502 (1855);
 Moore, Lepid. Ceylon, ii. p. 151 (1833); Hampson,
 Faun. Brit. Ind. Moths, i. p. 404 (1892).

Palpi broad, prominent: antennæ strongly pectinated at the base in the male, the pectinations shortening to the tip; body moderately stout; abdomen very long, slender and tapering in the male, much stouter in the female, and not extending much beyond the hind-wings.

SUANA CONCOLOR.

Lebeda concolor, Walker, List Lepid. Ins. Brit. Mus. vi.
 p. 1463, no. 12 (1855).

Lebeda bimaculata, Walker, *op. cit.* no. 13 (1855).

Suana ampla, Walker, *op. cit.* p. 1502, no. 1 (1855).

Suana bimaculata, Moore, Cat. Lepid. Ins. E. I. House, ii.
 p. 428, no. 972, pl. xxiii, figs. 1, 1a, b (transf.); pl. xiii.a,
 figs. 2, 2a (1859); id. Lepid. Ceylon, ii. p. 152, pl. 140,
 figs. 1, 1a, b (1883); Butler, Ill. Lepid. Heter. Brit. Mus.
 vi. p. 2, pl. 101, figs. 3, 4 (1886).

Suana concolor, Hampson, Faun. Brit. Ind. Moths, i. p. 406,
 fig. 281 (1892).

This handsome moth is a native of the East Indies, and exhibits the usual disproportion in size between the sexes which we find in the *Pinaridæ*, the male measuring about two inches and a half, and the female more than five inches across the wings.

The male is reddish-brown, the fore-wings are crossed by several blackish waved lines, and there is generally a white spot at the end of the cell. The sub-marginal line is macular;

and there are often some yellowish markings towards the hind margin. The female is much larger and paler, being reddish-brown, with purplish shades; the white spot at the end of the cell is larger and more distinct, and there is another towards the base.

“*Larva*.—Male greyish-brown, female mostly grey, numerous covered with short longitudinal black strigæ; slightly hairy above, the hairs pale brown, densely tufted with paler, brown-spotted, decumbent hairs along the side below the spiracles, the tufts projecting from warty protuberances; on front of third and fourth segments is a transverse raised protuberance, from each of which a dense short tuft of black hairs projects forward, and on twelfth and last segment is a short conical protuberance, the former of which is hairy. Head black-striped. Cocoon greyish-ochreous. Pupa purple-red. Feeds on *Careya arborea*, &c.—(*Dr. Thwaites*).” (*Moore*.)

The full-grown larva is not unlike that of *Gastropacha quercifolia*.

GENUS PINARA.

Pinara, Walker, List Lepid. Ins. Brit. Mus. iii. p. 761 (1855).

Entometa, Walker, *op. cit.* iv. p. 973 (1855).

Rhinogyne, Felder, Reis. Novara, Lepid. iv. pl. 84, figs. 9, 10 (1874).

In this genus, the palpi are stout, pilose, and prominent, the antennæ are long, and strongly pectinated to the tips in the male; and short, and minutely serrated beneath towards the tips, in the female. The legs are stout and hairy, and the hind tibiæ are armed with two short apical spurs.

This genus is confined to Australia and Tasmania, and the sexes are very dissimilar, not only in size and shape, but also in colour.

PINARA CANA.

(Plate CXI., Figs. 2, 3.)

Pinara cana, Walker, List Lepid. Ins. Brit. Mus. iii. p. 761, no. 1 (1855); vii. p. 1711 (1856).

This is a common species in Australia and Tasmania. The male measures an inch and a quarter across the wings, and the female about double. The male is brown, with very strongly pectinated antennæ, and a large black basal tuft; the fore-wings are blackish at the base and brown beyond. Beyond the middle runs a rather indistinct white transverse line, curved inwards at the costa, where it is broadest, beyond which is a rather irregular, oblique row of black conical spots, marked on the inner side with orange. The hind-wings are broadly black towards the costa, orange-tawny on the hind margin, and brownish on the inner margin. The female is grey, shading into brownish towards the costa of the fore-wings, and whitish on the hind-wings; the fore-wings are crossed by slightly oblique rows of black spots, marked inwardly with tawny, as in the male, within which is a faint trace of the commencement of the white line on the costa. The body is pale grey, slightly tinged with tawny on the thorax; the antennæ are black.

There are several closely allied Australian species of *Pinara*.

FAMILY XXXVII. ZEUZERIDÆ.

Egg (of *Phragmataecia castaneæ*).—Thin-shelled, smooth, somewhat iridescent (Hellins).

Larva.—Almost naked, with a few scattered hairs; boring galleries in growing wood, or living in reeds.

Pupa.—Formed in the galleries, and furnished with spines by which it can push itself forward; sometimes enclosed in a cocoon of wood or silk.

Imago.—Of moderate or large size, with the mouth parts rudimentary, the antennæ pectinated to the middle or to the tip, at least in the males; frenulum present, consisting of several bristles in the female; cells of all the wings bisected by a nervure, which forms a shorter or longer fork towards the extremity; fore-wings, with an accessory cell above the upper extremity of the discoidal cell; hind-wings, with three submedian nervures. Body very stout, or long and tapering; female provided with an ovipositor.

The *Zeuzeridæ* (or, as they are often called, *Cossidæ*) are a family numbering upwards of forty genera, and are widely distributed. Their complicated neuration, coarsely-scaled wings, and the habits of the larva show considerable resemblance to the *Castniidæ*, from which, however, they differ by the structure of their antennæ, and by their nocturnal habits.

Some authors consider them to be allied to the *Tortrices*.

GENUS TRYPANUS.

Cossus, Fabricius, Ent. Syst. iii. (2), p. 3 (1794); Ochsenheimer, Schmett. Eur. iii, p. 89 (1810); Godart, Lépid. France, iv. p. 41 (1822); Curtis, Brit. Ent. ii. pl. 60 (1825); Stephens, Ill. Brit. Ent. Haust. ii. p. 9 (1828); Walker, List Lepid. Ins. Brit. Mus. vi., p. 1510 (1856).

Trypanus, Rambur, Cat. Lépid. de l'Andalousie, ii. p. 326 (1866).

Body very stout, the abdomen extending somewhat beyond the hind-wings; antennæ longer than the thorax, pectinated to the tip in the male, and serrated in the female. Wings broad;

fore-wings broad, with the costa curved, and the hind margin not very oblique; fore-wings about twice as long as broad; hind-wings rounded, longer than broad.

I reject the name *Cossus* as applied to this genus, for it is admitted to be objectionable to employ specific names, which should be inviolable, in a generic sense; nor do I consider the compromise of *Cossus cossus* sufficiently elegant to be adopted. Swainson was the chief author who attempted to introduce the practice of taking specific for generic names into Entomology; but this has been followed in so few instances that they can easily be eliminated. In ornithology and in some other branches of natural history, the practice has attained to such dimensions that it would be difficult, if not impossible, to eradicate it; but there is no reason why this should not be successfully attempted and carried out in Entomology.

THE GOAT MOTH. TRYPANUS COSSUS.

(Plate CXXIV., Fig. 1; larva, Fig. 2.)

Bombyx cossus, Linnæus, Syst. Nat. (ed. x.) i. p. 504, no. 40 (1758); id. Faun. Suec. p. 295 (1761); Esper, Schmett. iii. p. 303, Taf. 61 (1786); Hübner, Eur. Schmett. iii. fig. 198 (1804?).

Cossus ligniperda, Fabricius, Ent. Syst. iii. (2), p. 3, no. 1 (1794); Ochsenheimer, Schmett. Eur. iii. p. 90 (1810); Godart, Lépid. France, iv., p. 47, pl. 3, fig. 1 (1825); Stephens, Ill. Brit. Ent. Haust. ii. p. 9 (1828); Kirby, Eur. Butterflies and Moths, p. 112, pl. 26, figs. 1 a-c (1880); Buckler, Larvæ of Brit. Lepid. ii. pp. 59, 135, pl. 31, fig. 3 (1887); Barrett, Lepid. Brit. Isl. ii. p. 146, pl. 61, figs. 3, 3 a (1894).

The Goat Moth has an extended range throughout Europe and Western Asia, as well as in North Africa. It expands

from two inches and three-quarters to three inches and a half.

The antennæ are pale grey, with black pectinations. The head and collar are pale grey, the latter bordered with yellow. The thorax is brownish-grey, varied behind with whitish, bordered with a curved black transverse stripe. The abdomen is ashy grey, ringed with pale grey.

The fore-wings are grey, clouded with dark brown, and traversed by a network of waved dark transverse lines, two transverse stripes towards the hind margin being broader and more conspicuous than the others. The hind-wings are dark grey, and resemble the fore-wings, but are only slightly reticulated. On the under side the fore-wings are brown, and the hind-wings pale grey; otherwise they are nearly as above.

The larva feeds in the trunks and bark of willow, alder, poplar, oak, lime, elm, chestnut, apple, pear, and other trees, requiring three years to attain maturity. The head is black, the second segment yellow, with a large black dorsal mark, and the rest of the back shining dark red, appearing as if polished. The sides are yellow. It emits a very disagreeable smell, which has led to the insect being called the Goat Moth.

The pupa is reddish-brown, striped with yellow on the abdomen, which is provided with short bristles on each segment. The cocoon is covered with particles of wood, and is lined with very tough silk.

The moth appears in June and July.

GENUS STYGIA.

Stygia, Latreille, Nouv. Dict. d'Hist. Nat. xxi., p. 262 (1803); xxiv., p. 185 (1804); Godart, Lépid. France, iii., p. 167 (1821); Walker, List Lepid. Ins. Brit. Mus., viii., p. 2 (1856.)

This genus includes only a few small species which are confined to South Europe and Western Asia. The antennæ are pectinated and rather short, the body and legs very pilose, the wings small, and the abdomen very long, extending much beyond the hind-wings, and tufted on the sides and at the extremity.

STYGIA AUSTRALIS.

(Plate CXXIV., Fig. 3.)

Stygia australe, Latreille, Nouv. Dict. d'Hist. Nat. xxi., p. 262, (1803).

Stygia australis, Latreille, *op. cit.* xxiv., p. 185 (1805); id. Hist. Nat. Crust. Ins., xiv., p. 141 (1805); id. Gen. Crust. Ins. i., pl. 14, figs. 4, 5 (1806); iv., p. 215 (1809); Godart, Lépid. France, iii., p. 169, pl. 22, fig. 19 (1821); Kirby, Eur. Butterflies and Moths, p. 113 (1880).

Bombyx terebellum, Hübner, Eur. Schmett. iii., fig. 244 (1804).

Chimæra leucomelas, Ochsenheimer, Schmett. Eur. ii., p. 6 (1808).

This species is common in Southern Europe. It expands about an inch. The head and thorax are brownish-yellow, and so are the antennæ. The abdomen is elongated, blue-black in colour with a small anal tuft. The fore-wings are narrow, brownish in the male, with greyish-white markings, and the hind-wings are rounded, blue-black, with a large white spot in the centre. In the female the fore-wings are reddish-yellow, varied with brownish, and the hind-wings are coloured as in the male.

The larva, which is smooth and whitish, with the head and thoracic segments yellowish, lives in the roots and stalks of *Echium italicum*.



GENUS ZEUZERA.

- Zeuzera*, Latreille, Nouv. Dict. d'Hist. Nat., xxiv., p. 186 (1804); Stephens, Ill. Brit. Ent. Haust. ii., p. 8 (1828); Walker, List Lepid. Ins. Brit. Mus. viii., p. 1528 (1856); Moore, Lepid. Ceylon, ii., p. 153 (1883).
Zenzera, Latreille, Hist. Nat. Crust. Ins. xiv., p. 175 (1805).

In this genus, the antennæ of the male are strongly pectinated to the middle, and are then simple to the tip; in the female they are simple. The wings are long and narrow, and the abdomen is rather stout, pubescent, much longer than the hind-wings, and provided with an ovipositor in the female.

THE WOOD LEOPARD MOTH. ZEUZERA PYRINA.

(Plate CXXV., Fig. 1; larva, Fig. 2.)

- Noctua pyrina*, Linnæus, Faun. Suec., p. 306 (1761).
Phalæna hippocastani, Poda, Mus. Græc., p. 88, no. 16 (1761).
Noctua æsculi, Linnæus, Syst. Nat. (ed. xii.), i. (2), p. 833, no. 83 (1767).
Bombyx æsculi, Esper, Schmett. iii., p. 311, Taf. 62 (1786); Hübner, Eur. Schmett. iii., fig. 202 (1804).
Cossus æsculi, Ochsenheimer, Schmett. Eur. iii., p. 99 (1810); Godart, Lépid. France, iv., p. 54, pl. 3, figs. 2, 3 (1822).
Zeuzera æsculi, Stephens, Ill. Brit. Ent. Haust. ii., p. 8 (1828); Kirby, Eur. Butterflies and Moths, p. 113, pl. 26, figs. 2 a, b (1880); Buckler, Larvæ of Brit. Lepid. ii., p. 132, pl. 31, fig. 1 (1887); Barrett, Lepid. Brit. Isl. ii., p. 143, pl. 61, figs. 2, 2 a-c (1894).

The Wood Leopard Moth is found throughout Europe and North Africa. The male expands about two inches, and the female two inches and a half, or more.

The head and thorax are white, the latter marked with three blue-black spots on each side placed longitudinally. The abdomen is blue-black, with white hair between the segments and on the sides, and is terminated by a projecting brown ovipositor in the female. The wings, which are rather thinly scaled, are shining white, the fore-wings are lanceolate and covered with black spots with a blue or green lustre. The hind-wings are whitish, spotted with pale grey, but the spots are much fewer than on the fore wings, and it is only on the hind margin that a row of blue-black spots is visible. The triangular area at the inner margin is pure white.

The larva feeds in the trunk and branches of a number of trees and shrubs, including the walnut, elm, lime, birch, chestnut, oak, beech, ash, willow, privet, lilac, holly, whitethorn, pear, apple, &c. It is yellow, with raised shining black dots, each having a fine short hair on it. On the head are two black spots and it has a broad shining black plate on the second segment. The last segment is also shining black. The pupa is reddish-brown with the sides of the body and edges of the wing-cases light brown, while the abdomen is provided with fine hooklets. It is formed in a firm cocoon under the bark. The moth flies by night, and appears in August. It is not generally very common in England, but is most frequently observed in the neighbourhood of London.

GENUS CHALCIDICA.

Chalcidica, Hübner, Verz. bek. Schmett. p. 197 (1822?).

This is a long-winged genus allied to *Zeuzera*, but conspicuous for the bright colours of the typical species, which inhabit the tropics of the Old World.

CHALCIDICA MINEA.

(Plate CXXV., Fig. 4.)

Bombyx mineus, Cramer, Pap. Exot. ii., pl. 131, fig. D (1777);
Donovan, Ins. Ind., pl. 53, fig. 1 (1800).

Zeuzera viridicans, Eschscholtz in Kotzebue's Reise, iii.,
p. 219, Taf. 11, fig. 29 (1821).

Zeuzera minea, Duncan in Jardine's Nat. Libr. Exot. Moths,
p. 109, pl. 8, fig. 4 (1841).

Zeuzera mincus, Walker, List Lepid. Ins. Brit. Mus. vii.,
p. 1535, no. 16 (1856).

Duomitus mineus, Hampson, Faun. Brit. Ind. Moths, i., p. 309
(1892.)

This handsome moth is a native of India, Java, and the Philippines. The male expands about three inches and the female four inches.

The antennæ, head, thorax, and abdomen are of a fine dark metallic blue. The wings are pale orange, with blue markings, the fore-wings having eight small spots along the costa, a large transverse oval spot near the base, and a broad longitudinal spot from beyond the transverse spot nearly to the apex, with several circular and oblong marks above it. There is also a series of spots on the hind margin, which is continued on the inner margin. The hind-wings have a very broad central blue spot, two spots on the costa near the tip, and several on the hind margin.

GENUS XYLEUTES.

Xyleutes, Hübner, Verz. bek. Schmett., p. 195 (1822?).

Morpheis, Hübner, *op. cit.* p. 196 (1822?).

Strigoides, Guérin, Icon. Règne Anim. iii., p. 505 (1844).

Xyrena, Herrich-Schäffer, Aussereurop. Schmett. i., fig. 162
(1854).

Endoxyla, Herrich-Schäffer, *op. cit.* p. 7 (1855).

Hinnæya, Moore, *Lepid. Ceylon*, iii., p. 153 (1883).

This genus includes a considerable number of very large and bulky moths, with long wings, and long stout hairy abdomens. They inhabit most of the warmer countries of the world, but are perhaps most numerous in Australia. They are of large size, often measuring six inches or more across the wings, and of dull colours—brown, reddish-brown, and grey or whitish, being the prevailing hues. The typical species is *X. strix* (Linnaeus), which inhabits Java and Amboina.

GENUS PHRAGMATÆCIA.

Macrogaster, Duponchel, *Cat. Lépid. Eur.*, p. 81 (1844),
nom. præocc.

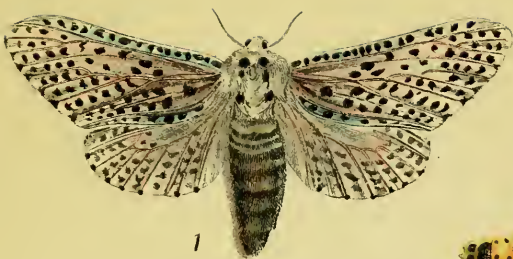
Phragmatæcia, Newman, *Zoologist*. viii., p. 2931 (1850);
Walker, *List Lepid. Ins. Brit. Mus.* vii., p. 1542 (1856);
Hampson, *Faun. Brit. Ind. Moths*, i, p. 312 (1892).

This is a small genus, distinguished by its long, narrow, rounded, and uniformly-coloured wings, and its long slender abdomen. The antennæ are pectinated to the middle in the male, and are ciliated in the female. The larva lives in the interior of reeds.

THE REED MOTH. PHRAGMATÆCIA CASTANÆÆ.

Bombyx castaneæ, Hübner, *Beitr. Schmett.*, ii. (1), p. 9, Taf. 1,
fig. C (1790); Esper, *Schmett.*, iii., *Forts.*, p. 97, Taf. 94,
figs. 1, 2 (1807).

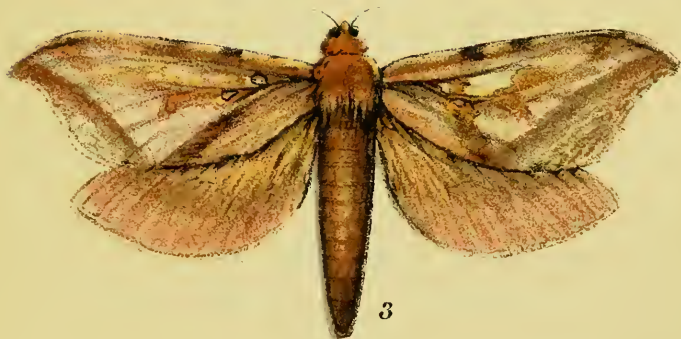
Bombyx arundinis, Hübner, *Eur. Schmett.*, iii., figs. 200, 201
(1803).



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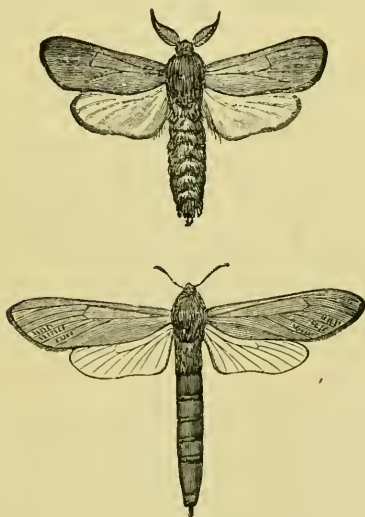
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1. *Zeuxera pyrina*
 2. do do larva.
 3. *Sthenopis argenteomaculata*.
 4. *Chalcidica minea*.

Cossus arundinis, Ochsenheimer, Schmett. Eur., iii., p. 98 (1810).

Macrogaster arundinis, Duponchel, Lépid. France, Suppl., iii., p. 136, pl. 13, figs. 2 a, b (1836); Barrett, Lepid. Brit. Isl., ii., p. 140, pl. 61, figs. 1-1 a, b (1894).

Phragmatæcia arundinis, Kirby, Eur. Butterflies and Moths, p. 113 (1880); Buckler, Larvæ of Brit. Lepid., ii., pp. 58, 133, pl. 31, fig. 2 (1887).



Reed Moth. Male and Female.

The Reed Moth is found occasionally in swampy places in many parts of Europe. It expands from an inch and a half to two inches. The head and thorax are brownish-grey, and the abdomen projects far beyond the hind-wings, especially in the

female. It is brownish in the male and light grey in the female, with a broad anal tuft, and prominent ovipositor. The fore-wings are long and narrow, somewhat rounded at the tips, with the inner margin curved. They are brownish or greyish-white, dusted with dark brown atoms arranged in streaks. The fringes are chequered with light brown and dark grey. The hind-wings are light grey in the male and whitish in the female.

The larva feeds on the pith in the stems of the common reed. It is elongated; yellowish, pale reddish-brown above, with a whitish dorsal line. The head and cervical plates are brown.

It remains in the portion of the stem which is below the water, or under the ground, until it is about to pupate, when it ascends and makes a rounded excavation towards the surface, leaving only a thin membrane. It then spins a white silky cocoon, and becomes transformed into a long fusiform pupa of a dark brown colour, with very short brownish wing-cases, which form a pointed elevation above the head, and with very fine hooklets on the abdominal segments. The moth appears about the end of May, or in June, and is very local in the English fens.

FAMILY XXXVIII. ARBELIDÆ.

This is a small family lately founded by Sir George Hampson to receive one or two genera previously included in the *Zeuzeridæ*, from which they differ chiefly in the absence of a frenulum, and in the nervure bisecting the cells of the wings not being forked. The species, which inhabit India and Ceylon, are of moderate size and of dull colours, and the antennæ of the male are bipectinated to the tips. The abdomen is much longer than the hind-wings. The larvæ are wood-borers like the *Zeuzeridæ*. The discoidal cells are divided by a simple nervure.

GENUS ARBELA.

Arbela, Moore, Proc. Zool. Soc. London, 1879, p. 411; id., Lepid. Ceylon, ii., p. 155 (1883); Hampson, Faun. Brit. Ind. Moths, i., p. 314 (1892.)

In this genus the legs and body are hairy, and the long abdomen is moderately stout, and strongly tufted at the extremity. In the hind-wings the costal and sub-costal nervures are connected by a cross-nervule before the middle.

ARBELA QUADRINOTATA.

(Plate CXXIV., Fig. 4.)

Cossus (?) *quadrinotatus*, Walker, List Lepid. Ins. Brit. Mus. vii., p. 1521 (1856).

Arbela quadrinotata, Moore, Lepid. Ceylon, iii., p. 155, pl. 143, fig. 3 (1883); Hampson, Faun. Brit. Ind. Moths, i., p. 314 (1892).

Cossus abruptus, Walker, List Lepid. Ins. Brit. Mus. xxxii., p. 584 (1865).

This species inhabits India and Ceylon, and the female expands an inch and a half, and the male somewhat less. The male is brown, with yellowish-grey fore-wings, with numerous reddish-brown transverse dashes arranged in irregular rows; those between the base and the end of the cell, and some towards the base below the cell, being larger, and darker brown; the hind-wings are blackish, with grey fringes, spotted with brown.

The female is grey, darker on the hind-wings, and flecked on all the wings with brown, the largest spots extending from the middle of the base of the fore-wings towards the hinder angle.

FAMILY XXXIX. HEPIALIDÆ.

Egg.—Small, round, oval, white at first, but soon turning black.

Larva.—Cylindrical, with scattered hairs; feeding on or in the roots of low plants, but the larger species in the wood of trees.

Pupa.—Slender, enclosed in a slight cocoon in loose earth, or in the burrows of the larvæ.

Imago.—With rather long and narrow wings; hind-wings with the same neuration as the fore-wings; antennæ short; proboscis and frenulum obsolete; but the place of the latter supplied by a “jugum,” which is a lobe near the base of the fore-wings, projecting below the costa of the hind-wings.

On account of the two characters above emphasized, which occur only in the families *Hepialidæ* and *Micropterygidæ*, some recent authors have proposed to separate these two otherwise very dissimilar families as a primary section of the *Lepidoptera* under the name of *Jugatæ*. They are assumed to be the sole surviving representatives of the original root-stock of the order *Lepidoptera*. To me, this assumption, and the erection of two discordant families into a main section on the strength of two characters only, appears to be at least premature.

GENUS HEPIALUS.

Hepialus, Fabricius, Syst. Ent. p. 589 (1775); Latreille, Nouv. Dict. d'Hist. Nat. xxiv. p. 186 (1804); Stephens, Ill. Brit. Ent. Haust. ii., p. 4 (1828); Curtis, Brit. Ent. iii., pl. 185 (1826); Godart, Lépid. France, iv., p. 30 (1832); Boisduval, Icones Lépid. ii., p. 185 (1834?); Duponchel, Cat. Lépid. d'Eur. p. 82 (1844); Walker, List Lepid. Ins. Brit. Mus. vii., p. 1550 (1856).

Hepiolus, Illiger, Mag. Insekt. i., p. 138 (1802); Ochsenheimer, Schmett. Eur. iii., p. 103 (1810)

Epialus, Lederer, Verh. Zool.-bot. Ges. Wien. ii., p. 73 (1852.)

Size small or moderate; antennæ short; wings considerably longer than broad; hind-wings often as long as the fore-wings, but usually narrower; abdomen moderately stout, but not very long; flight crepuscular; larvæ feeding at or in the roots of low plants. In the male, the hind tibiæ are strongly tufted, and in some species the hind tarsi are absent in the male.

Hepialus, though now restricted to the most typical species of the *Hepialidæ*, still includes a considerable number of species, chiefly European, Asiatic, and North American.

THE GHOST MOTH. HEPIALUS HUMULI.

Noctua humuli, Linnæus, Syst. Nat. (ed. x.) i., p. 508, no. 62 (1758); id. Faun. Suec., p. 305 (1761); Sulzer, Gesch. Ins. Taf. 22, fig. 1 (1776); Esper, Schmett. iv. (1), p. 20, Taf. 80, figs. 1-4 (1786).

Bombyx humuli, Hübner, Eur., Schmett. iii., figs. 263, 264 (1804?)

Hepiolus humuli, Ochsenheimer, Schmett. Eur. iii., p. 104 (1810).

Hepialus humuli, Godart, Lépid. France, iv., p. 30, pl. i., figs. 1, 2 (1822); Stephens, Ill. Brit. Ent. Haust. ii., p. 6 (1828); Kirby, Eur. Butterflies and Moths, p. 115, pl. 26, figs. 4 a, b (1880); Buckler, Larvæ of Brit. Lepid. ii., p. 131, pl. 30, fig. 3 (1887); Barrett, Lepid. Brit. Isl. ii., p. 165, pl. 63 (1894.)

Var. *Hepialus thulensis*.

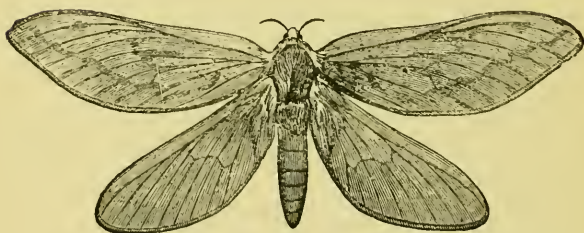
Hepialus humuli, var. *thulensis*, Crotch, Entom. ii., p. 176 (1865).

Hepialus humuli, var. Knaggs, Entom. Annual (1865), p. 98 ;
Millière, Ann. Soc. Linn. Lyon. (2), xvii., p. 11, pl. 94
(iii.), figs. 5, 6 (1869.)

Hepialus humuli, var. *hethlandica*, Staudinger, Cat. Lepid.
Eur. (ed. ii.), p. 60, no. 784 (1871) ; Weir, Entom., xiii.,
p. 251, pl. 3 (1880).



The Ghost Swift (*Hepialus humuli*). Male.



The Ghost Swift. Female.

The Ghost Moth is common throughout Europe. It expands from one and a half to two and a half inches.

The antennæ are reddish-brown ; the head, thorax, and abdomen are yellowish-grey. The wings are lanceolate, shining white above in the male. and dark brown beneath. In the

female, the fore-wings are pale yellow, streaked and spotted with brick-red. The hind-wings are light grey, merging into pale reddish-yellow towards the edges. The under side resembles the upper, but is without markings, and the fore-wings are sometimes shaded with darker.

The variety *H. thulensis*, which occurs constantly in the Shetland Islands, and rarely in Holland, is peculiar in that the male has more or less of the markings of the female. Some specimens are white, with grey or reddish markings on the fore-wings, whilst others have yellow fore-wings marked with dusky or reddish spots, and grey hind-wings, while others again are dusky.

The larva feeds on the root of the hop, and various other low plants from August till the following spring. It is yellowish, with a yellowish-brown head and cervical plate, and with scattered short black hairs over the body. The pupa is elongated and of a reddish-brown colour, with short wing-cases, and fine hooklets on the abdominal segments. It is enclosed in a large cocoon, formed of earth and particles of sand, in the ground. The moth appears in June and July, and has a peculiar slow hovering flight in meadows at dusk, the white fore-wings of the male appearing and disappearing in a manner that is thought to have given rise to the name of Ghost Moth; or the name may have been derived from the moth having been noticed in abundance in churchyards.

THE WOOD SWIFT. HEPHALUS SYLVINUS.

(Plate CXXVI., Fig. 4.)

Noctua sylvina, Linnæus, Faun. Suec., p. 306 (1761); Esper, Schmett. iv., p. 32, Taf. 82, figs. 2-4 (1786).

Bombyx hanna, Denis & Schiffermüller, Syst. Verz. Schmett. Wien. p. 62, no. 2 (1776); Hübner, Eur. Schmett. iii., figs. 207, 252, 300 (1804?)

Bombyx flina, Denis & Schiffermüller, Syst. Verz. Schmett. Wien., p. 61, no. 3 (1776).

Noctua flina, Esper, Schmett. iv., p. 35, Taf. 82, fig. 5 (1786).

Bombyx lupulina, Hübner (nec Linnæus) Eur. Schmett. ii., figs. 205, 206 (1804?).

Hepialus sylvinus, Ochsenheimer, Schmett. Eur. iii., p. 109 (1810); Curtis, Brit. Ent. iii., pl. 185 (1826); Stephens, Ill. Brit. Ent. Haust. iv., p. 7 (1828); Kirby, Eur. Butterflies and Moths, p. 115 (1880); Buckler, Larvæ of Brit. Lepid. ii., p. 57, pl. 30, fig. 5 (1887); Barrett, Lepid. Brit. Isl. ii., p. 158, pl. 64, figs. 1 a, b (1894).

Cossus sylvinus, Godart, Lépid. France, iv., p. 43, pl. 2, figs. 1-5 (1822).

The Wood Swift is found throughout Europe. The male expands from one inch to one inch and a quarter, and the female from one inch and a quarter to one inch and three-quarters.

The head, antennæ, and thorax, as well as the fore-wings, are in the male reddish-yellow, yellowish-brown, or more rarely brick-red. A whitish, sinuous line extends from the base of the fore-wings to the inner margin, and another similar line, bordered on its inner side with dark brown, runs from the apex to the inner margin close to the first. In the middle of the wing is a dark brown spot bounded with white below. Beyond the outer line is a series of small dark brown spots, and in front of the fringes, which are reddish, is a row of dark-brown lunules, with the concavity directed outwards. The hind-wings are ashy grey (rarely uniform reddish-yellow), varied with reddish or ochre yellow towards the hind margin. The abdomen is yellowish-grey, with a brownish anal tuft. The under side is yellowish-grey, shaded with blackish in the middle. The female is of a more or less deep cinnamon-

brown, with the markings arranged as in the male, but with a broad grey band, narrowly edged on both sides with white, replacing the outer white line and more nearly meeting the inner line at an angle. The other markings are less distinct than in the male, and the hind-wings are uniform ashy-grey.

The larva feeds on the underground rhizomes of bracken fern (*Pteris aquilina*) as well as on succulent roots, such as that of the dock, &c. The larva is ivory-white, and much wrinkled. The head is orange-brown, and there is a brownish-orange plate on the back of the second segment, and similar marks on the third and fourth segments. The spiracles are dark brown.

The pupa is chestnut-brown, with hooklets on the abdominal segments, and is enclosed in a cocoon near the surface of the ground, lying in a burrow which runs spirally upwards from the root in which the larva has fed.

The moth is not uncommon in July and August, and the male may often be seen flying rapidly among ferns at dusk.

GENUS STHENOPIS.

Sthenopis, Packard, Proc. Ent. Soc. Philad. iii., p. 390 (1864);
Stretch, Zyg. & Bomb. N. Amer., p. 104 (1872).

This genus includes about half a dozen North American species, which are considerably larger than *Hepialus*, with longer, broader, and more pointed wings, and a longer abdomen. The head is small, and there is a large square tuft of hair on the hind tibiæ. The species are brown or grey, with silvery markings, and the larvæ feed in the stems of alder, &c.

STHENOPIS ARGENTEOMACULATUS.

(Plate CXXI., Fig. 3.)

Hepialus argenteomaculatus, Harris, Rep. Ins. Mass., p. 295
(1841); Kellicott, Insect Life, i., p. 250 (1889).

This species is a native of the Eastern United States, but is considered local, and is seldom met with in abundance.

"Its body and wings are rather long. It is of an ashen-grey colour; the fore-wings are variegated with dusky clouds and bands, and have a small triangular spot and a round dot of a silvery-white colour near their base; the hind-wings are tinged with ochre-yellow towards the tip. It expands two inches and three-quarters." (*Harris.*)

The larva is white, with three black spots on each side of the second segment, arranged in a triangle; the head and legs are yellowish, the former black below, and there is a row of yellow piliferous spots on the back. The pupa is slender, with two spines on the clypeus, another on the lower part of the head, and two conical processes on the pro-thorax, bifid above; abdominal serrations very fine.

The larva bores in the roots and stems of the spotted or hairy alder (*Alnus incana*).

A larger species (*S. quadriguttatus*, Grote), confounded with this by Harris, is found in Canada. I have therefore thought it best to quote Harris's earliest and most typical description.

GENUS CENETUS.

Cenetus, Herrich-Schäffer, Aussereurop. Schmett., i., p. 5 (1855).
Charagia, Walker, List Lepid. Ins. Brit. Mus., vii., p. 1569 (1856); Scott, Trans. Ent. Soc. N. S. Wales, ii., p. 25 (1873).

Philopsyche, Scott, Austral. Lepid., ii. pl. 11 (1890).

Hepialus, Meyrick, Proc. Linn. Soc. N. S. Wales (2), iv. p. 1127 (1890).

The largest and handsomest species of *Hepialidæ* are found in Australia and New Zealand. Many of these measure six or seven inches in expanse, and are usually brown or reddish, with

conspicuous silvery markings. Their larvæ feed in the wood of trees, like those of the *Zeuzeridæ*. There is also a beautiful Australian genus, which may easily be distinguished by its moderately broad wings, with conspicuous green markings, and the long abdomen. The species are of moderate size, and the type of the genus *Ænetus* is here described and figured.

ÆNETUS LIGNIVORUS.

(Plate CXXVI., Figs. 1, 2; larva, Fig. 3.)

Hepialus lignivorus, Lewin, Prodr. Ent., pl. 16 (1805); Boisduval, Voy. Austrolabe, Lépid., p. 234 (1832); Duncan in Jardine's Nat. Libr., Exot. Moths, p. 107, pl. 8, figs. 1-3 (1841); Meyrick, Proc. Linn. Soc. N. S. Wales, ii., p. 1129 (1890).

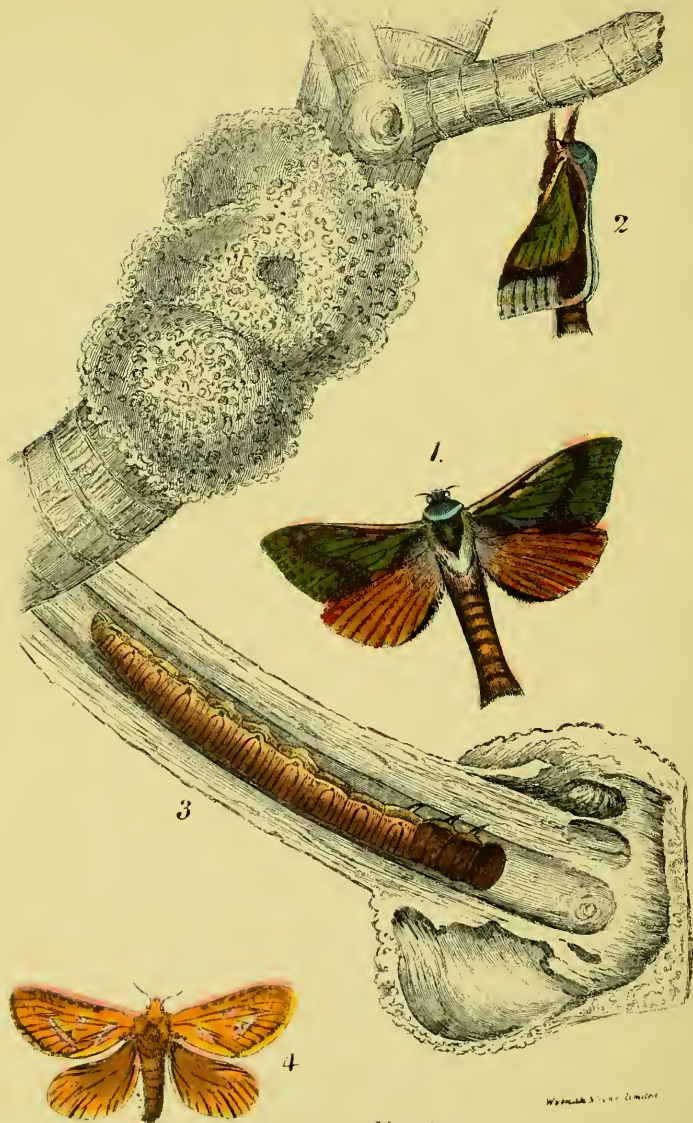
Charagia lignivora, Walker, List Lepid. Ins. Brit. Mus. vii., p. 1570, no. 3 (1856); Scott, Austral. Lepid., i., p. 5, pl. 2 (1864); id. Trans. Ent. Soc. N. S. Wales, ii., p. 29 (1873).

Ænetus lignivorus, Kirby, Cat. Lepid. Heter. i., p. 891 (1892).

This beautiful species is a native of Australia. It expands about two inches.

The fore-wings are of a brilliant yellowish-green, divided into two patches by a waved band of ferruginous brown intersected with dusky, and several small sharply-defined marks of scarlet and some short dashes of the same colour on the costa. The fringes are brown, and the external green patch is intersected by a broad, waved light brown line. The hind-wings are reddish flesh-colour, shaded with dusky on the inner margin, and tinged with blue at the base. The antennæ are brown, the head and collar are bluish-grey, the thorax green, like the fore-wings, and the abdomen is long, with a dark tuft at the extremity.

The larva is pale green, shaded with darker, and with the head and anterior segments dark brown. It forms a hollow in the middle of the stem of a species of *Casaurina*, or she-oak, and feeds on the bark and sappy wood directly above the entrance, eating round the stem, and carefully hiding its depredations by weaving particles of wood and bark, which it gnaws off, in a strong web. It thus forms at the same time a fortification and disguise of considerable bulk and thickness around the stem, under which, in a winding cylindrical passage, the larva constantly keeps its body while at work, alternately gnawing and weaving; but retires to the chamber in the stem to repose. Across the mouth of this chamber it spins a close web, and enters the pupa state in January, soon after which the concealing fabric, to form which the larva took so much pains, falls away. It remains in this state for twenty-five days, when by a strong vertical motion of its joints and serrated rings, the pupa forces its way through the web, and the moth emerges, usually in February.



1. 2. *Enetus lignivorus*
 3. do do larva.
 4. *Hepiatus sylvinus*.

Weyrauch Sculp. Zimelini

SKETCH OF THE LITERATURE

OF

LEPIDOPTERA.



One of the greatest difficulties in the more advanced study of Entomology arises from the mass of literature, scattered through thousands of books and periodicals, in at least eighteen different languages. The expense and difficulty of forming a really useful entomological Library is very considerable ; and there are very few public libraries, outside those in the largest cities or in the most important university towns, which are well furnished in this respect. With care and judgment, however, a student who restricts himself to the study of a limited group, or a limited fauna, may obtain sufficient materials to form the nucleus of a good working library at a moderate outlay, if he will watch the catalogues of English and foreign booksellers, and buy exactly what he needs most, when he meets with it at a reasonable price. His greatest difficulty will be with the periodicals, but many important papers published in periodicals are to be obtained separately, and it will always be worth while for a really serious student to copy (or have copied) notes from rare books that he cannot otherwise obtain, including sketches or copies of figures, when necessary. Again, when an Entomologist visits a library, he should not waste his time in looking over books at random, but should ask immediately for what will be most useful to him, unless, indeed, his time is practically unlimited. I have, therefore, thought it would be

useful to give a short sketch of the literature of *Lepidoptera*, though it will be understood that I can only mention those which I consider the most important and most useful books, and I have had to leave unmentioned hundreds of others, perhaps hardly less useful or interesting, which will be found quoted in bibliographies and catalogues; nay, in many instances, even in the present work.

LANGUAGES.

To begin at the beginning, I have already said that eighteen languages at least are employed in entomological works at the present day. They may be divided into five classes, as regards *Lepidoptera*, though, with respect to some of the other orders of insects, the classification would be rather different, as far as the relative importance of some of the languages is concerned.

CLASS A.

Languages of the first importance, in which every Entomologist should endeavour to perfect himself.

ENGLISH. (Most important periodicals: Publications of the British Museum, and of the Entomological, Zoological, and Linnean Societies; Entomologists' Monthly Magazine; Entomologist; Entomologist's Record; Annals and Magazine of Natural History; Rothschild's "Novitates Zoologicæ"; Zoological Record; which last, together with Hagen's "Bibliotheca Entomologica," published at Leipzig in 1862, furnishes a nearly complete index to the whole literature of Entomology from the commencement of the study to the present day.)

FRENCH. (Most important periodicals: Annales de la Société Entomologique de France; ditto, de Belgique; Annales de la Société Linnéenne de Lyon, &c.)

LATIN. (Much used for diagnoses, as well as for many independent works)

GERMAN. (Periodicals too numerous to mention ; those published at Berlin, Vienna, Dresden, Stettin, and Frankfort-on-Main, are perhaps the most important.)

CLASS B.

Languages containing a large amount of important Entomological information, but which are not placed in Class A, because much of the work done by Entomologists in the countries where they are spoken is published in one or other of the four principal languages included in Class A.

DUTCH. (Principal periodical, *Tijdschrift voor Entomologie* ; chiefly important for the *Lepidoptera* of Holland, and the islands of the Malayan Archipelago.

SWEDISH. (Most important periodicals : *Entomologisk Tidskrift* ; and the publications of the Konglige Vetenskaps Akademie at Stockholm. The Swedes often write in Latin, and the Finnish Entomologists (the Scientific Society at Helsingfors often issues valuable works) usually write in Latin, Swedish, or German. I have seen books on Botany in Finnish, but none on Entomology.)

RUSSIAN. (Most important publications : Those of the Academy of St. Petersburg, the Society of Naturalists at Moscow, and the "*Horæ Societatis Entomologicæ Rossicæ*." The Russians generally write in Latin, French, or German, but there are many extremely important Entomological papers, especially on insect anatomy and morphology, which are only published in Russian.)

CLASS C.

Languages containing valuable papers on Lepidoptera, but not of large amount, or of very great importance, except for special purposes.

ITALIAN. (Most important periodicals: *Buletino della Società Entomologica Italiana*; *Il Naturalista Siciliana*; and the publications of the Academy of Naples.)

SPANISH. (Principal periodical: *Anales de la Sociedad Española de Historia Natural*.)

PORTUGUESE. (Principal periodical: *Jornal de Sciencias Mathematicas, Physicas et Naturaes publicado sob os auspicios da Academia real das Sciencias de Lisboa*.)

DANISH. (Principal periodical: *Naturhistorisk Tidsskrift*.)

NORWEGIAN.* (Principal periodicals: *Nyt Magazin for Naturvidenskaberne*; *Tromsø Museums Aarshefter*.)

CLASS D.

Languages in which Entomological papers are sometimes published, but seldom any of great importance.

POLISH, CZECH, MAGYAR.

CLASS E.

Languages in which Entomological papers have been published; but with probably nothing of importance relating to Lepidoptera.

CROATIAN, MODERN GREEK, JAPANESE.

Outside Europe many important books and periodicals on Entomology are published in Canada, the United States, India,

* Written Norwegian is hardly distinguishable from Danish.

Australia, Chili, Buenos Aires, &c.; full lists of all important periodicals are included in the annual volumes of the "Zoological Record," already referred to.

*Books on Lepidoptera in general.**

The first really important contributions to general Entomology were probably the collections of copper-plates published by Petiver, at the beginning of the last century, for a list of which I must refer to Hagen's "Bibliotheca Entomologica;" and Ray's "Historia Insectorum," edited, after Ray's death, by Lister, in 1710. The last work laid the foundation of the classification of insects, and both Petiver's and Ray's works were much used, and frequently quoted, by Linnæus.

The actual commencement of our modern system of classification, however, was invented and carried out by Linnæus, especially in the tenth and twelfth editions of his "Systema Naturæ." I have already sufficiently noticed these works (i., pp. 2, 3; iv., pp. xxiv.-xxvi.), and will now confine myself to quoting a single description from Linnæus' "Systema," tenth edition (i., p. 496), in order to illustrate his method.

Paphia 4. *P. Bombyx* elinguis flava, alis patulis falcatis concoloribus, ocello fenestratis M. L. V.

Pet. gaz. t. 29, f. 3. Catesb. car. 2, p. 91., t. 91.

Habitat in Guinea.

Petiver's figure represents a common West African Moth, belonging to the genus *Antheræa* (*anted*, p. 97); and this must be considered the typical figure, as against a supposed type of Linnæus, still existing in the remains of Queen Louisa Ulrica's

* This section includes works treating of both Foreign Butterflies and Moths together; but works dealing specially with European *Lepidoptera* will be discussed separately.

collection at Stockholm,* which belongs to *A. rumphii*, Felder, a moth found in Amboina. As Linnæus, judging from his remarks in three successive works, apparently had three or four specimens of different species before him, which he confounded under the name of *Bombyx paphia*, I cannot attach any importance whatever to so very doubtful a "type."

J. C. Fabricius was a native of Schleswig, and a pupil of Linnæus, who attached himself particularly to the study of insects; and Linnæus is reported to have said of him, "when I see Fabricius with an insect, I take off my hat." His autobiography, edited by the late Rev. F. W. Hope, will be found in vol. 4 of the first series of the "Transactions of the Entomological Society of London." When a young man, he travelled much, and afterwards became a Professor at Kiel. He still continued to travel; and a considerable portion of his life was spent in England, where he was intimate with Banks, Solander, and other naturalists of the day. The types of most of the insects which he described from Sir Joseph Banks' collection are fortunately still preserved in the British Museum.† The principal works which he published on insects (in which *Lepidoptera* are included), are as follows:—"Systema Entomologiæ" (1775, when it was still possible to describe all the known insects in a single 8vo. volume of less than 900 pages!); "Genera Insectorum" (1777); "Species Insectorum" (two vols., 1781); "Mantissa Insectorum" (two vols., 1787); "Entomologia Systematica" (four vols., 1792-1794, and supplement, 1798), and his unfinished "Systema Glossatorum" (vide vol. i. pp. 6, 7).

* A critical *résumé* of this collection was published by Professor Aurivillius in the Swedish "Händlingar" in 1882.

† Cf. Butler's "Catalogue of Diurnal *Lepidoptera*, described by Fabricius, in the Collection of the British Museum": published by order of the Trustees in 1869; with three plates.

I have thought that it might be interesting to give a short table of the number of species of *Lepidoptera* described in the first and last of the general works of Linnæus and Fabricius respectively, arranged under the three original genera of Linnæus, *Papilio*, *Sphinx*, and *Phalæna*:—

| Genera. | L. 1758. | L. 1767. | F. 1775. | F. 1793-4. |
|--------------|----------|----------|----------|------------|
| Papilio..... | 192 | 273 | 406 | 1,147 |
| Sphinx..... | 38 | 47 | 77 | 165 |
| Phalæna .. | 305 | 460 | 528 | 1,107 |
| | 535 | 780 | 1,011 | 2,419 |

During this period, several important quarto books of plates of *Lepidoptera* were published in Sweden, Holland, and England, and were quoted by Linnæus and Fabricius.

Among the best illustrations of insects published during the last century were those of Rösel von Rosenhof, a miniature painter of Nuremberg, who issued his “*Insecten-Belustigung*” in monthly parts. They form four volumes in small quarto, and appeared between 1746 and 1761. The third and fourth volumes were edited by Kleemann after Rösel’s death, and Kleemann subsequently added a fifth, under the title of “*Beiträge zur allgemeinen Natur und Insectengeschichte.*” This appeared between 1761 and 1776. These books contain a considerable number of European and Exotic *Lepidoptera* the latter chiefly Butterflies.

Two volumes by Clerck, illustrating European and Exotic *Lepidoptera*, to which Linnæus’s Latin names were attached, were prepared at the expense of the Queen of Sweden, and issued in 1759 and 1764. A few more plates of Exotic

Lepidoptera were also prepared for a proposed third volume, which was never published.

Three volumes of "Illustrations of Natural History," were published by D. Drury, a goldsmith in the Strand, in 1771, 1773, and 1782; and a new edition was issued by Westwood in 1837, under the title of "Illustrations of Exotic Entomology." The greater part of the insects figured in this work are *Lepidoptera*, and among them are many species from Sierra Leone, which continued, till within the last few years, to be of almost unattainable rarity in collections. A German translation of the first volume was published by Panzer in 1785-1788, of which I possess a nearly complete copy. In 1776 Sulzer published his "Abgekürzte Geschichte der Insecten nach dem Linneischen System," which includes several well-executed coloured plates of *Lepidoptera*. In 1785, Roemer re-issued the plates of this work, with some additions and new letterpress, under the title of "Genera insectorum Linnei et Fabricii iconibus illustrata."

We now come to a book which is still one of the most valuable collections of plates of Exotic *Lepidoptera* in existence—Cramer's "Papillons Exotiques," published at Amsterdam, in Dutch and French. There are four volumes, containing 400 plates. The latter part of this work was edited by Stoll (see vol. iii., p. 106, note); and Stoll subsequently published a Supplement, or fifth volume, comprising 42 plates, on which many transformations are figured, as well as perfect insects. These volumes were issued in parts, and as far as I have been able to ascertain, after considerable research (cf. "Entomologists' Monthly Magazine," xiv., pp. 278, 279, May, 1878), the dates of issue were as follows:—

| | | | | | |
|---------|------|--------|-----|-----|------|
| Vol. I. | pls. | 1-84 | ... | ... | 1775 |
| | | 85-96 | ... | ... | 1776 |
| II. | pls. | 97-192 | ... | ... | 1777 |

| | | | | |
|----------|--------------|-----|-----|------|
| Vol. III | pls. 193-264 | ... | ... | 1779 |
| | 265-288 | ... | ... | 1780 |
| IV. | pls. 289-336 | ... | ... | 1780 |
| | 337-384 | .. | ... | 1781 |
| | 385-400 | .. | ... | 1782 |
| V. | pls. 1- 8 | ... | ... | 1787 |
| | 9- 42 | ... | ... | 1790 |

Subsequently to the Fabrician era, we may mention the following works on *Lepidoptera* in general, which will come better here than under a more definite heading.

Here we may include Donovan's three works, "Insects of China," "India," and "New Holland" (1798, 1800, 1805), and his "Naturalist's Repository" (5 vols., 1823-1827), which contain many *Lepidoptera*, mostly, but by no means exclusively, Butterflies. New editions of the "Insects of China" and "India" were published by Westwood in 1842; but the "Insects of New Holland," which has not been republished, is the most valuable, not only because most of the species figured in it are there noticed for the first time, but because they are really from Australia; whereas most of those figured in the "Insects of India" are not Indian at all, but South American, or African.

About 1805 or 1806 Hübner commenced the publication of his two great works on Exotic Entomology; the "Sammlung exotischer Schmetterlinge," and the "Zuträge zur Sammlung exotischer Schmetterlinge." The "Sammlung" consists of 439 quarto plates, each representing a single species. Hübner completed two volumes; but except the heading of the plates there is no letterpress, beyond an index to each volume, and twelve pages, each describing a single species, in Latin on one side and in German on the other. Geyer published 32 plates after Hübner's death, forming part of an unfinished third volume. There is no letterpress, except the

lettering of the plates, but Geyer has added the locality beneath the name of each species. Hübner's two volumes were published between 1806 and 1824, and Geyer's additional plates about 1835 or 1836. The "Zuträge" consists of 172 plates, with indices and German letterpress, divided into five "centuries," each volume depicting the upper and under side of 100 species; the whole thus consisting of five thin volumes in which 1,000 figures, representing 500 species, are contained. These volumes bear date 1818, 1823, 1825, 1832, and 1835, and the last three were edited, if not written, by Geyer. The species figured in the "Sammlung" are large species, chiefly Butterflies; and those figured in the "Zuträge" are smaller species, and chiefly Moths. Hübner's "Sammlung" is now being re-issued by M. Wystmann, in Belgium, and is to be followed by the "Zuträge."

Various editions of Cuvier's "Règne Animal" appeared in France and England, several of which contain valuable information on *Lepidoptera*. The most important cognate work is probably Guérin-Ménéville's "Iconographie du Règne Animal." The plates were published in 1829, and were reproduced by G. R. Gray in 1833 in vol. xv. of Griffith's "Animal Kingdom;" but Guérin-Ménéville's text, which includes descriptions of many new species not figured on his plates, was not published till 1844.

There is a series of important French works in octavo, with plates, known as the "Nouvelles Suites à Buffon." Of these, eight volumes relate to *Lepidoptera*; one by Boisduval (1836) containing *Papilionides* and *Pierides*; six by Guenée: "Noc-tuélites" (3 vols., 1852), "Deltoides et Pyralites" (1 vol., 1854), and "Uranides et Phalénites" (2 vols., 1857); and finally Boisduval published a volume of "Lépidoptères Héterocères," including *Castnides*, *Sphingides*, and *Sesiides*. This book bears date 1874, but was not published till 1875.

Most of the volumes of this series are very carefully written, and those of Guenée will be referred to again in our vol. v. (see also *anted* p. xxx.). They were, however, extravagantly over-estimated in England for some years after their publication.

Two volumes of Chenu's "Encyclopédie d'Histoire Naturelle" relate to *Lepidoptera* (Papillons), and were published about 1857. They are very cheap, and are illustrated with a great number of excellent woodcuts. The first volume, which contains Butterflies, *Castnides*, *Sphinges*, &c., is by far the most valuable, not only because it is more accurate and better written than the second, but because it is largely based upon Doubleday, Hewitson, and Westwood's "Genera of Diurnal *Lepidoptera*," always a costly book, of which we shall speak later on.

In 1850-1858, Herrich-Schäffer published a valuable series of coloured plates of Exotic *Lepidoptera*, under the title of "Sammlung neuer oder wenig bekannter aussereuropäischer Schmetterlinge," and in 1869 he published the first part of a proposed second volume, which he did not live to continue. The complete volume does not include descriptions, but lists of species, characters of genera, and a revised system of *Lepidoptera*. (Cf. *anted*, p. xxx.)

Lepidoptera generally form a more or less important part of the reports of scientific voyages and expeditions, but most of these sink into insignificance before the magnificent series of five volumes of quarto plates forming the lepidopterous section illustrating the Voyage of the Novara (Reise der Österreichischen Fregatte Novara um die Erde). This voyage, however, fruitful as it was of scientific results, mainly served as an opportunity to Dr. Cajetan Felder, the Burgomaster of Vienna, to make known to the world the many rare and beautiful species contained in the public and private collections of Vienna. The whole series of plates amounts to 139. Three volumes of *Rhopalocera* were published by Dr. Felder and his son, Rudolf

Felder, between 1864 and 1867, and after the early death of the latter (one of the greatest losses that Entomology has ever sustained) two volumes of Moths were edited by Dr. Rogenhofer (without other text than indices) in 1874 and 1875. Of course, in the case of species of *Ornithoptera* and *Morpho*, even large quarto plates will only hold two figures ; but some of the plates illustrating the smaller Moths contain upwards of 60 figures.

Between 1869 and 1874, Dr. A. G. Butler published a serial work in quarto parts, called "*Lepidoptera Exotica*." It contains 64 coloured plates, and though Moths are not wholly omitted, most of the species figured are Butterflies, the opportunity having been taken to include a complete illustrated monograph of the group of *Pieridæ* formerly included in the genus *Catopsilia*, Hübner, or *Callidryas*, Boisduval. (Cf. vol. ii. pp. 228-230.)

Mons. C. Oberthür, of Rennes, who at present possesses by far the best collection of *Lepidoptera* in France, is publishing a finely-illustrated work on the Order under the title of "*Études d'Entomologie*." The parts have no fixed bulk or regular date of appearance, and many of them are specially devoted either to a limited group, or to the fauna of some particular country.

Works devoted to special groups of Lepidoptera.

Butterflies.

One of the first works devoted exclusively to Butterflies, and also one which deserves notice as being the first attempt to arrange the whole group in natural order, was that of Jablonsky and Herbst, "*Natursystem aller bekannter in- und aus'ändischen Insecten*." The entire work consists of twenty-one volumes, of which vols. i.-x. include *Coleoptera*, and vols. xi.-xxi., *Lepidoptera*. These last eleven volumes were published at Berlin from 1783 to

1804. They include all the Butterflies except the *Plebeii Rustici* (= *Urbicolæ* of Linnæus, or the modern *Hesperiidæ*), and the work would probably have been continued further but for the death of Herbst in 1807. The arrangement adopted is a modification of the systems of Linnæus and Fabricius. The book is in octavo, but the 144 coloured plates are in oblong quarto. The book is, however, rarely quoted, for it contains scarcely any new matter, the figures being almost all copied from the works of Drury, Cramer, Esper, and other authors, collated and rearranged.

Another work of a similar character which demands a passing notice here is Esper's "Ausländischen Schmetterlinge," published at Erlangen, in parts, between 1785 and 1798, and republished by Charpentier in 1830 with two additional plates, raising the total number to 35 plates. Esper's work contains little original matter, and consists of figures of Butterflies (chiefly *Equites* in the Linnæan sense) copied from Cramer and other authors. Charpentier's additional plates illustrate Moths.

In the years 1819 and 1823 appeared two parts of the great French work, the "Encyclopédie Méthodique," forming vol. ix. of the series on "Histoire Naturelle : Entomologie." These consist exclusively of the article "Papillon," by Latreille and Godart, and form a comprehensive monograph of the Butterflies known at the period. The articles on *Lepidoptera* published in other volumes of the "Encyclopédie Méthodique," as well as a volume of plates, in which many *Lepidoptera* are represented, are now of comparatively little value; but vol. ix. will always hold its place as an entomological classic.

Lucas' "Histoire Naturelle des Lépidoptères (exotiques) étrangers," of which there are two editions (1835 and 1845), and Thon's "Naturgeschichte der in- und ausländischen Schmetterlinge" (Eisenach, 1837) are illustrated semi-popular books of secondary importance.

In 1846, Edward Doubleday commenced a large work entitled "*Genera of Diurnal Lepidoptera*," which was illustrated by W. C. Hewitson, who had lately taken up the study of Butterflies. After Doubleday's death, the work was carried on by Prof. J. O. Westwood. It forms two folio volumes, with eighty-eight coloured plates, and may be said to have inaugurated the modern era of the study of Butterflies. (Cf. vol. i. p. 5).

By this time Hewitson had completely abandoned the study of British Entomology and Oology, and had resolved to devote the rest of his life to Exotic *Lepidoptera*. With the collaboration, in the first instance, of W. Wilson Saunders (a liberal patron of Entomology, who amassed a fine collection of insects of all orders, though his business engagements precluded him from working much at them himself), Hewitson commenced an illustrated work, entitled "*Exotic Butterflies*," in 1851. It was issued in quarterly parts, containing three plates each, and continued to appear till 1877, when five volumes, of sixty plates each, had appeared, a large proportion of the species figured being derived from the exertions of three travelling naturalists: Bates and Wallace on the Amazons; Wallace in the Malay Archipelago; and Buckley in Ecuador and Bolivia. For many years Hewitson's collection remained unrivalled, and at his death he bequeathed his whole collection, contained in seven magnificent cabinets, to the British Museum. He confined his attention exclusively to Butterflies, and he used to say that if he were to commence the formation of a collection of Moths as well, he would have to build himself a larger house.

In 1887 a work on similar lines was commenced by Messrs. H. Grose Smith and W. F. Kirby (in quarterly parts of three plates, and volumes of fifty plates each), the second volume of which will be completed with the publication of the part for April, 1897.

I became intimate with the late Mr. H. W. Bates after his return from the Amazons, and the sight of his working lists of the various families of Butterflies suggested to my mind the first idea of my "Synonymic Catalogue of Diurnal *Lepidoptera*," which I shortly afterwards had an opportunity of preparing, after my removal to Dublin. It was published in 1871, and the Supplement in 1877, and forms a complete index to the literature of the subject up to the latter date. (Cf. vol. i. p. 7).

I have, in the previous volumes, already spoken at sufficient length of the important works of Staudinger, Schatz, and Röber, on Exotic Butterflies.

Works on separate families of Butterflies—

Nymphalidæ—Satyrinæ.

In 1868, Dr. A. G. Butler published a "Catalogue of Diurnal *Lepidoptera* of the Family *Satyridæ* in the Collection of the British Museum," describing a number of new species and varieties, and illustrated with five plates.

Lycenidæ.

Not content with his "Exotic Butterflies," Hewitson proposed an illustrated Catalogue of *Lycenidæ* to the Trustees of the British Museum; but after the publication of a specimen part, including the genera *Ogyris* and *Amblypodia*, they refused to continue it. Upon this, Hewitson decided to continue it in a quarto form, similar to his "Exotic Butterflies," and seven parts of this work had appeared at the time of his death in 1878; and an eighth, which was left practically ready for publication, was issued afterwards. The parts published include most of the genera allied to *Thecla* (*Lycæna* and *Plebeius* and their allies not being touched), and a great number of new species are figured and described, a large proportion of which are Tropical American species.

Equitidæ.

I have already mentioned Mr. Rippon's monograph of *Ornithoptera* (vol. ii., p. 251).

In 1852 G. R. Gray published his quarto "Catalogue of Lepidopterous Insects in the Collection of the British Museum. Part i., *Papilionidæ*." It included descriptions of many new species, and was illustrated with thirteen coloured plates, and one plain one. It was intended to form the first volume of a series, but was never continued.

Moths.

Most of the special works on Moths have been or will be noticed under the families to which they belong. The titles of Boisduval's "Essai sur une Monographie des Zygénides" (Paris, 1829) and Maassen and Weymer's "Beiträge zur Schmetterlingskunde" (five parts, containing figures of *Saturniidæ*, published at Elberfeld, from 1869 to 1886) may close this section of our bibliography.

*Local Faunæ.**Europe and Palæarctic Region generally.*

The literature relating to separate countries will be discussed under suitable headings. Detailed information respecting nearly every important work on European *Lepidoptera* published up to 1798 will be found in Werneburg's "Beiträge zur Schmetterlingskunde" (2 vols., Erfurt, 1864).

Three books of the last century deal with European *Lepidoptera* as a whole. The first and most important of these is Esper's "Schmetterlinge in Abbildungen." It was published at Erlangen in quarto, in eighty-four parts, forming five volumes, usually bound in seven. The book was commenced in 1777, and the main portion was completed about 1804; but later

supplements were added by other writers up to 1829, and from 1829 to 1839 appeared a new issue, with some additions by Charpentier. The work includes the *Macro-Lepidoptera* as far as the *Geometridæ*, and describes the metamorphoses of many species, while the letterpress, too, is very full. It still remains one of the best and most complete publications on European *Lepidoptera* as a whole; for in the works of later authors the letterpress is often very scanty, and the insects and their metamorphoses are frequently described in different works.

About the same time a similar work was commenced in France—Ernst and Engramelle's "Papillons d'Europe." It consists of eight quarto volumes, including coloured plates of *Macro-Lepidoptera* and their metamorphoses as far as the *Noctuæ*. It was begun in 1779, and was continued until 1792, when it was discontinued, probably in consequence of the French Revolution. The illustrations are good, and the book might have acquired much greater importance if the authors had condescended to adopt the Linnean classification, instead of using French names only for the insects figured.

Borkhausen's "Naturgeschichte der Europäischen Schmetterlinge" is a work in five octavo volumes, published at Frankfort-on-Main from 1788 to 1794. There are no plates (two coloured frontispieces excepted), but the book is carefully written, and is still of some value to Lepidopterists of the present day.

We now come to the most important series of works which illustrate the *Lepidoptera* of Europe; those of Hübner, Geyer, and Herrich-Schäffer. Jacob Hübner was a designer in a cotton factory in Augsburg (Rösel, before him, had been a miniature painter), who turned his attention to Entomology, and after publishing one or two smaller works, began the great series of illustrations of European and Exotic *Lepidoptera* which have made his name famous. I have already spoken of his works on Exotic *Lepidoptera*. His largest work on European

Lepidoptera is entitled "Sammlung europäischer Schmetterlinge," or "Der europäische Schmetterlinge." It was continued and completed, after Hübner's death, by Geyer and Herrich-Schäffer, and the whole forms eight sections, comprising 790 quarto coloured plates. It was commenced in 1793, and only completed in 1841; and Herrich-Schäffer afterwards published a supplementary work under the title of "Systematische Bearbeitung der Schmetterlinge von Europa." This work appeared at Regensburg (Ratisbon) in sixty-nine parts, and is complete in six volumes, from 1843 to 1856, and includes 636 coloured, and 36 plain plates. Hübner, though an excellent and indefatigable artist, was not a literary man, and the letterpress to most of his works is very scanty and incomplete; Herrich-Schäffer's, though much compressed, is very useful, but now, of course, out of date. The plates, however, never will be. It is very difficult to obtain a really good copy of Hübner's great work; for early copies, coloured by himself, usually want the later additions; and the colouring of the supplements of later issues, which contain all the newest matter, is not so good.

There is yet another important work of Hübner's to be mentioned, his "Geschichte europäischer Schmetterlinge (Raupen)," published at Augsburg, from 1806 to 1818, or later; and including 406 plates of larvæ, from which many later authors have drawn freely, even Curtis not hesitating to copy Hübner's plates when needful.

Contemporaneously with Hübner's plates, appeared the standard German work of Ochsenheimer and Treitschke, describing and classifying the species. Ochsenheimer commenced a work on the *Lepidoptera* of Saxony, and published one volume, including the Butterflies, in 1805, but relinquished it in favour of a more comprehensive work, "Die Schmetterlinge von Europa." The whole forms ten volumes, dating from 1807

to 1834; the first four being by Ochsenheimer, and the remainder written by Treitschke after Ochsenheimer's death.

In 1820, Godart commenced his "Papillons de France," a work in octavo, of which he published five volumes, and the book was continued by Duponchel. The work was completed in eleven volumes, and four supplementary volumes, and appeared from 1821 to 1842. The plates and descriptions are good, and this still remains the standard French book on European *Lepidoptera*. Godart's first plan was to limit himself to the *Lepidoptera* of the neighbourhood of Paris, but the scheme was soon extended to include those of France, and ultimately of all Europe.

Here we may notice some important works on European *Lepidoptera* which do not aim at completeness, but rather to extend the knowledge of new or rare species and their transformations.

Between 1828 and 1830, C. F. Freyer published three little volumes at Nuremberg, illustrating rare *Lepidoptera* under the title of "Beiträge zur Geschichte europäischer Schmetterlinge, mit Abbildungen nach der Natur." This work was followed by a more extended one, in seven volumes of a larger size, published at Augsburg, from 1833 to 1858, under the title of "Neuere Beiträge zur Schmetterlingskunde."

In these works, new or rare species were described and figured, but Fischer von Röslerstamm's "Abbildungen zur Berichtigung und Ergänzung der Schmetterlingskunde, besonders der Microlepidopterologie," published at Leipzig from 1834 to 1843, deals chiefly with the life-histories of the smaller Moths. It is illustrated with 100 coloured plates.

The great Dipterist Meigen was likewise a Lepidopterist, and published a work entitled "Systematische Beschreibung der Europäischen Schmetterlinge," which is less known than it deserves to be, as the figures and descriptions are good. It

appeared at Aix-la-Chapelle, from 1827 to 1832, and extends as far as the *Noctuæ* inclusive.

One of the most prominent French Entomologists during the second and third quarters of the present century was Dr. J. A. Boisduval. In 1829 and 1840, he published two catalogues of European *Macro-Lepidoptera*, which profoundly affected the systems of classification in use for many years, *i.e.*, his "Europæorum Lepidopterorum Index Methodicus;" and his "Genera et Index Methodicus Europæorum Lepidopterorum." These were supplemented by Guenée's "Europæorum Micro-Lepidopterorum Index Methodicus" (Paris, 1845), of which, however, only the first part appeared, extending to the beginning of the *Tineæ*.

Boisduval also published a useful series of plates of European *Macro-Lepidoptera*, under the title of "Icones historiques des Lépidoptères d'Europe," and also, with the collaboration of Rambur and Graslin, a work on larvæ, entitled "Collection iconographique et historique des Chenilles d'Europe" (1832-1843). In some respects Duponchel's later work ran parallel with Boisduval's, for in 1832-1842 he also published an "Iconographie des Chenilles;" and in 1844 a very important "Catalogue méthodique des Lépidoptères d'Europe."

Many popular works on European *Macro-Lepidoptera* have appeared in France and Germany, of which the most notable is Berge's "Schmetterlingsbuch," first published at Stuttgart in 1842. It has gone through many editions in Germany, and a later edition, edited by Hoffmann, formed the basis of my "European Butterflies and Moths" (1879-82), though I greatly enlarged upon the original work. (I had previously—in 1862—published a small "Manual of European Butterflies," the first English book on Continental European *Lepidoptera*). The plates have also been used for a similar work by Aurivillius (Nordens Fjärilär, Stockholm, 1888-1891), adapted to

Northern Europe, and augmented with additional woodcuts. I have also seen French and Italian works illustrated by Berge's plates, but in these the letterpress is simply written up to the plates, and is of little or no value. Another German popular work of somewhat similar character to Berge's, but less comprehensive, is Korb's "*Schmetterlinge Mittel-Europa's*" (Nuremberg, n. d.), of which an English adaptation by Mr. A. W. Kappel and Dr. W. Egmont Kirby, was published in 1895, under the title of "*British and European Butterflies and Moths.*"

The best recent German popular works on European *Macro-Lepidoptera* and their larvæ, are those published by Hofmann a year or two ago, and in these all the attainable species are figured.

The most complete catalogue of European *Lepidoptera* is, at present, Staudinger and Wocke's "*Catalog der Lepidopteren des Europäischen Faunengebiets.*" Two editions have appeared, in 1861 and 1871, and Entomologists are now anxiously waiting for a third, on which Dr. Staudinger is understood to have been working for some years. His part of the work (the *Macro-Lepidoptera*) is much more complete and accurate than Dr. Wocke's (the *Micro-Lepidoptera*). This work was originally designed on the lines of Heydenreich's "*Verzeichniss der Europäischen Schmetterlinge,*" of which several editions appeared between 1843 and 1851.

The most important contributions to the life-history of European *Lepidoptera* made of late years, are contained in Millière's "*Iconographie et Lépidoptères inédits,*" published in 1874 in three large octavo volumes. These successive papers on new and rare *Lepidoptera* and their transformations began to appear as early as 1858, in the "*Annales de la Société Linnéenne de Lyon,*" and Millière carried on his researches at Cannes for many years, the three volumes men-

tioned embodying the greater part of the results of his life-work in this direction (though he also published some smaller books and papers on *Lepidoptera*) comprising much additional matter not previously published in the "Annales." Millière's work is not exclusively confined to French *Lepidoptera*, or I should have noticed it later on.

Works on separate groups of Palæarctic Lepidoptera.

The most complete descriptive work on the subject generally is Fritz Rühl's "Die palæarktischen Grossschmetterlinge und ihre Naturgeschichte," of which one volume, containing the Butterflies, has been published at Leipzig (1892-95).

Butterflies.

Since the publication of my works on European *Lepidoptera* already mentioned, several others have appeared in English, of which the most important is Dr. Lang's "Butterflies of Europe" (1881-1884), in which all the species, and the transformations of many of them, are described and figured.

Gerhard in his "Versuch einer Monographie der Europäischen Schmetterlingsarten: *Thecla*, *Polyommatus*, *Lycæna*, *Nemeobius*" (Hamburg, 1850-1853) furnishes us with a very useful and interesting set of figures, but the letterpress is very meagre.

Austaut, "Les Parnassiens de la Faune Paléarctique" (Leipzig, 1889), has given us a series of descriptions and illustrations of the beautiful and, till recently, little known genus *Parnassius*, most of which inhabit the mountains of Central Asia. (Cf. also Elwes, P.Z.S., 1886, pp. 6-53)

Moths.

The *Ægeriidae*, or Small Clearwings, were monographed by Laspeyres in a small work published at Berlin in 1801, under

the title, "*Sesiæ Europææ Iconibus et Descriptionibus illustratæ.*"

Another specially difficult family of small species, the *Psychidæ* (inclusive of several genera now separated from them), were dealt with by Bruand d'Uzelle in his "*Essai monographique sur la tribu des Psychides,*" published in the "*Bulletin de la Société d'Émulation du Doubs,*" in 1852, and issued separately at Besançon in the following year.

An important work by Lederer, on the classification of the *Noctuæ* ("*Die Noctuiden Europa's,*" Vienna, 1857), has been already referred to (*anteà*, p. xxx.).

Stainton's "*Natural History of the Tineina,*" consists of thirteen volumes published from 1855 to 1873. Each volume contains 24 species, the transformations of which are represented on eight plates (three species per plate), and the whole history of the species is discussed at great length in four parallel columns in English, French, German, and Latin, rendering the book an Entomological polyglot quite unique in its character.

Two other works of Stainton's may be mentioned here, "*The Tineina of Southern Europe*" (1869), and "*The Tineina of Syria and Asia Minor*" (1867). These, however, are to a large extent digests of scattered papers on the subject by previous authors rather than original works.

British Islands.

A.—Works on British Lepidoptera, from Petiver to Haworth.

As early as 1717 Petiver published six plates of British *Lepidoptera*, which were afterwards included in the collected edition of his works, in two volumes, edited by Empson in 1767.

Many *Lepidoptera* are figured in Albin's "*Natural History of*

English Insects" (1720), several editions of which appeared subsequently, one at least in Latin.

Wilkes' "English Moths and Butterflies" (1747-1760, and a second edition in 1773), and Harris's "Aurelian" (1766) close the pre-Linnean period. Several editions have appeared of the latter work, the last, which was edited by Westwood, as late as 1841.

Donovan's "Natural History of British Insects" (16 vols. 1792 to 1813) includes a considerable number of *Lepidoptera*.

The preceding works are chiefly of historical interest; the following are more important:—

Lewin's "*Papilios of Great Britain*" (1795) contains good figures and descriptions of transformations, habits, &c., of nearly all the butterflies now recognised as British. One or two of the species which he includes are now barely recognised as British, such as *Lycæna virgaureæ* (Linn.), and *Iphiclides podalirius* (Linn.), the former taken by himself. Although he figures two northern Butterflies, *Canonympha typhon* (Rott.), and *Polyommatus artaxerxes* (Fabr.), the latter for the first time, yet he does not appear to have obtained *Erebia æthiops*. *E. epiphron* (Knoch), as we know, was not discovered in Britain till after his time. One of the most interesting remarks in his book, nowadays, is perhaps the incidental observation that *Limenitis camilla* (Linn.) was "common in almost every wood in England." This appears to have been the case in Haworth's time too, a little later, for Haworth simply describes it, without saying more of localities than in the case of the commonest Butterflies; indeed, his other observations imply that it was common quite close to London. In the time of Stephens, however, it had already become more local.

Haworth's "*Lepidoptera Britannica*" (1803-1829) bridges over the period between the earlier writers and those of the present century; for there is a great break in English entomo-

logical literature between the early years of the century, when Haworth's book was written (though part of it was not published till much later), and the modern period, commencing with Stephens and Curtis.

Haworth's is the first attempt at a systematic work on the whole of the British *Lepidoptera*; but though he instituted several new genera, the Linnean and Fabrician classification was still, in the main, retained. He also endeavoured to extend Linnæus' system of uniform terminations by making the specific names of the *Bombyces* end in "-us." As there was practically little or no communication with Entomologists abroad in his time, and as British *Lepidoptera* are liable to so much insular variation that Guenée has called Britain "*Le pays des variétés*," it is not surprising that a comparatively large number of insects were described by Haworth as new which have since been regarded as mere varieties.

B.—*Works on British Lepidoptera subsequent to Haworth.*

Stephens's "*Illustrations of British Entomology: Haustelata*" (4 vols. 1827-1835) still remains one of the best systematic works on our *Lepidoptera* which we possess. Many of the species included in the earlier works on Entomology, including that of Stephens, are now excluded from our lists. These fall under several categories:—

(a.) Species indicated as British from mere ignorance and carelessness. Thus Turton, in his English edition of Linnæus' "*Systema Naturæ*" ("*A General System of Nature*," 1806) appears to have marked insects as British almost at random; but then Turton was not an Entomologist but a Conchologist.

(b.) Species accidentally introduced, including many exotic insects, chiefly North American, which have been taken in England from time to time. Naturally, the older Entomo-

logists had no means of knowing that they were not really British, and, of course, regarded them as indigenous.

(c.) Foreign specimens erroneously supposed to be British, or fraudulently represented to be so. In the latter instance it would rarely be prudent or worth while to go to the trouble of palming off anything which was not already reputed British, and a desirable rarity. But in such a case a different species might be introduced into our lists by error, as may be seen from the amusing example which I have related in vol. i. p. 142.

(d.) Species common on the Continent, and which might reasonably be expected to occur in England, but which are of great rarity in this country, or have recently become extinct. Most of such species were struck out of our lists by Henry Doubleday, but a considerable number belonging to the former category have since been reinstated. Among those not inserted in, but omitted from, our lists "without authority" and afterwards reinstated, I may mention *Pyropteron chrysidiformis* (Esp.), and among those which I believe to have recently become extinct in England, *Iphiclides podalirius* (Linn.).

(e.) Varieties or species erroneously identified with others occurring only on the Continent. Among these are varieties of the Clouded Yellow Butterfly which were mistaken for, and inserted in our lists as, *Eurymus myrmidone* and *E. chrysothème* of Esper; they are European species which could not reasonably be expected to occur in Britain at all. Stephens was the more exposed to such errors, as he was not only not in regular correspondence with Continental Entomologists, but was totally ignorant of German; for though the latter language was much studied in Edinburgh by literary men about the beginning of the century, it was so little known in England that Donovan actually wrote that "the letterpress of Rösel's book was quite useless on account of the language in which it was written." Stephens

made great use of the work of Ochsenheimer and Treitschke, but was obliged to depend almost entirely on the synonyms and the Latin diagnoses for the identification of their species, and complained bitterly that the book was not written entirely in Latin. Consequently it is not surprising that some species described by Stephens were wrongly identified by him as belonging to others which are not found in Britain.

Simultaneously with Stephens' work, appeared Curtis' "British Entomology" (16 vols. 1823-1840), in which representatives of the principal genera of British *Lepidoptera* were figured. Stephens' work, likewise, was not issued without plates, but the first work in which an attempt was made to figure all the known species of British *Lepidoptera* was W. Wood's "Index Entomologicus" (1833-1839), of which a second edition, with supplement, was edited by Westwood in 1852-1854. This book consists of a series of coloured plates, in which all the larger species are reduced to a uniform size; and a systematic catalogue of species, including localities, &c., is added.

About 1840, and in the following years, appeared several editions of Westwood and Humphreys' "British Butterflies and their Transformations," and "British Moths and their Transformations." Most of the accidentally-introduced and reputed British species were figured in these works, especially in the former, which was subsequently republished by Westwood in a smaller form, with the practical omission of the reputed species (which were relegated to an Appendix), under the title of "The Butterflies of Great Britain" (1855).

We have passed over several popular books on British *Lepidoptera*, but the first serious attempt to describe the whole of the British *Lepidoptera* with scientific accuracy in a cheap and popular form was made by H. T. Stainton in his "Manual of British Butterflies and Moths" (2 vols.), which was published

in threepenny monthly parts from 1856 to 1859, and has held its ground as the only complete and compact work on the subject until the recent publication of Mr. Meyrick's "Handbook" (*vide antea*, p. xxxix.). Stainton, however, gave only occasional woodcuts, and his work was supplemented, as Stephens's volumes had been by Wood's, by Newman's "Natural History of British Butterflies," and "Natural History of British Moths"—works in which all the species, as far as the *Geometræ* inclusive, are represented by woodcuts of the natural size. The woodcuts are, as a rule, very good, and these books have been reprinted several times. I have utilized many of these cuts in the course of the present work.

The number of more or less recent popular books on British *Lepidoptera* (by Morris, Lucas, Gordon, Tutt, and others) is innumerable, but the last general work which I propose to notice is Mr. C. G. Barrett's, "*Lepidoptera of the British Islands*," now in course of publication. It is the fullest and best account of British *Lepidoptera*, from the point of view of a British Entomologist, and includes figures and descriptions of all the British species, with exhaustive notices of habits, transformations, &c.

Several larvæ are figured in Mr. Barrett's work, but we have now to mention two other books devoted entirely to the transformations of British *Lepidoptera*. These are Owen Wilson's "*Larvæ of British Lepidoptera*" (1880), which includes the *Macro-Lepidoptera*, and Buckler's posthumous work on the same subject, of which the sixth volume, extending to the end of the *Noctuæ*, has just been issued by the Ray Society.

Most of the popular works on British *Lepidoptera* are confined to the *Macro-Lepidoptera*, or to the Butterflies; and those of sufficient importance have been already mentioned; but among the more special works I may mention the following:—

Tutt's "*British Noctuæ and their Varieties*" (4 vols.) is a book to be consulted by those interested in variation, on which subject Mr. Tutt is a specialist.

Leech's "*British Pyralides*" (1886), includes coloured figures and descriptions of all the British *Pyrales*, *Crambi*, and *Pterophori*.

Two volumes of a series of octavo publications called "*Insecta Britannica*," devoted to *Lepidoptera*, contain monographs on British *Tortrices*, by Wilkinson (1859), and on the *Tineina* and *Pterophorina*, by Stainton (1854). They are illustrated by a few plain plates.

France.

The most useful popular works on French *Lepidoptera* are those by Berce entitled "*Faune Entomologique Française : Lépidoptères*." The first consists of six small octavo volumes, with coloured plates and descriptions, which were published between 1867 and 1878, and comprise descriptions of all the species up to and including the *Crambi*. There is also a small and cheap popular edition in one volume, in which, of course, only a selection of species could be noticed ; but the plates are crowded with figures, many of which do not occur in the larger work, though this also contains a fair proportion of useful figures.

Holland.

One of the best and oldest collections of drawings and descriptions of European *Lepidoptera* is Sepp's "*Beschouwing der Wonderen Gods in de minstgeachte Schepzelen of Nederlandsche Insecten*," the publication of which was commenced at Amsterdam in 1715, and was continued by various hands, till eight thick quarto volumes, containing a total of 400 plates, had appeared, of which the last was completed by the

eminent Dutch Entomologist, Snellen Van Vollenhoven (not to be confounded with P. C. T. Snellen, whom we are about to mention), in 1860.

The most important publications on the *Lepidoptera* of Holland are those by Mynheer P. C. T. Snellen, of Rotterdam. They consist of three large octavo volumes, with a few plates of details, and are entitled "De Vlinders van Nederland: Macro-Lepidoptera" (Hague, 1867) and "De Vlinders van Nederland: Micro-Lepidoptera" (2 vols. Leyden, 1882; Cf. *anteà*, p. xxxiii.).

Belgium.

There is a work by Dubois, "Les Lépidoptères de la Belgique," containing coloured drawings of the transformation of Belgian *Macro-Lepidoptera*, which appeared in parts, from 1859 to 1884, and forms three volumes, octavo.

Germany, Switzerland, and Austria.

It will be most convenient to group these countries together.

One of the most important of the early local European Faunæ which we possess is Scopoli's "Entomologia Carniolica" (Vindobonæ, 1763), a work contemporaneous with Linnæus, and of such consequence that even those who date our nomenclature from the twelfth edition of Linnæus's "Systema" make a special exception in the case of so prominent a co-worker with Linnæus and Fabricius, who continually refer to him. A series of plates was prepared to illustrate this book, and though they were never published, many copies of the book are in existence with these illustrations. Scopoli published other works which contain *Lepidoptera*, but nothing of equal value and importance to his "Entomologia Carniolica."

Another work of somewhat later date is Schrank's "Fauna Boica" (3 vols. published at Nuremberg, Ingolstadt, and Landshut, from 1798 to 1804). It was written under great difficulties, owing to the terrible confusion of the period,* as he himself mentions in his preface to vol. ii.; but it is one of the most carefully-written works of the time. His work has been strangely neglected. Latreille referred to it, but often substituted his names for those of Schrank; and though I have succeeded in obtaining a tardy recognition of Schrank's merits as a systematist, yet his descriptions of species still require a thorough analysis, which they have not yet received; for the book was unfortunately published too late to fall within the limits of Werneburg's "Beiträge zur Schmetterlingskunde."

Zebrowski's "Owady Luskoskrzydte Czyli Motylowate Zokolic Krakowa" (Cracow, 1860), which is a descriptive catalogue of the *Lepidoptera* of Cracow, with uncoloured illustrations, deserves notice, not on account of its importance, which is not greater than that of any other local Fauna, but because it is one of the few entomological books written in Polish; and because the writer was the first Entomologist who proposed a classification by which the Butterflies were sandwiched in the middle of the Moths (*vide antea*, p. xxxix.).

The best modern descriptive manual of German *Lepidoptera*, is Von Heinemann's "Schmetterlinge Deutschlands und der Schweiz." It is in three volumes (without plates), and was published at Brunswick between 1859 and 1877, the concluding half of the third volume having been edited by Dr. Wocke after Von Heinemann's death.

Another work, by Dr. Adolf Speyer and August Speyer, "Die geographische Verbreitung der Schmetterlinge Deutsch-

* "What a year!" says Schrank, speaking of 1796. Vivid traditions of the great wars were still rife in all parts of Germany.

lands und der Schweiz" (2 vols. Leipzig, 1858 and 1862), is very valuable for its observations on the habitats of *Lepidoptera*, and its enumeration of their localities throughout Europe, &c. The first volume included Butterflies, *Sphinges*, and *Bombyces*, and the second, *Noctue*.

As far as Switzerland is concerned, however, a work by Professor Frey, "Die Lepidopteren der Schweiz" (Leipzig, 1880) will supply fuller and more recent information, though it does not include descriptions of species. An earlier work, "Die Tineen und Pterophoren der Schweiz" (Zürich, 1856), is descriptive of the *Tineæ* and *Pterophori*, as its name indicates.

Scandinavia.

Linnæus' "Fauna Suecica" (two editions, 1746 and 1761), is now more of historical and classificatory, than of general, interest.

In addition to the work of Professor Aurivillius (*anteà*, p. 176,) the Butterflies, *Sphinges*, and *Bombyces* have been described by Pastor Wallengren in Swedish, with Latin diagnoses, in his "Skandinaviens Dagfjärilär" (Malmö, 1853) and "Skandinaviens Heterocerfjärilär" (1863-1885.).

Lapland.

A good foundation for the study of the *Lepidoptera* of Lapland was laid by Zetterstedt in his "Insecta Laponica descripta" (Leipzig, 1840).

Italy.

Besides smaller works, such as Petagna's "Specimen Insectorum ulterioris Calabriæ," of which editions were published at Naples, Frankfort, and Leipzig in 1786, 1787, and 1808 (?); and Cyrillo's "Entomologiæ Neapolitanæ specimen primum" (Naples, 1787-1792), in which several Neapolitan

Lepidoptera were figured, in addition to other insects, three rather important works on Italian *Lepidoptera* were published during the last century. A large portion of the second volume of Rossi's "Fauna Etrusca" (Liburni, 1790), is devoted to *Lepidoptera*; and several more species are described in his "Mantissa Insectorum" (Pisa, 1792-1794). A later work is De Prunner's "Lepidoptera Pedemontana" (Turin, 1798); but this includes only Butterflies and *Sphinges*.

The most useful work on Italian *Lepidoptera* issued during this century is the section devoted to the order in Costa's "Fauna del Regno di Napoli," published in quarto, with coloured plates, at Naples, from 1832 to 1836.

Corsica.

This Fauna is fairly well-known, but there is no exhaustive work. In 1832 and 1833, Rambur published a catalogue of the *Lepidoptera* in the "Annales de la Société Entomologique de France," vols. 1 and 2. There are also some observations on Corsican *Lepidoptera*, by Bellier de la Chavignerie, in the same "Annales" for 1862.

Spain.

Rambur has given an account of a portion of the *Macro-Lepidoptera* of Southern Spain in his "Faune Entomologique de l'Andalusie" (Paris, 1838-1839); and "Catalogue systematique des Lépidoptères de l'Andalusie" (Paris, 1858 and 1866).

Greece.

Dr. Staudinger's "Beitrag zur Lepidopteren Fauna Griechenlands" was published in the "Horæ Societatis Entomologicæ Rossicæ," vol. xii., for 1870.

Russia.

A great portion of the Entomological literature of Russia is published in periodicals; but one or two separate works may be mentioned. Vol. v. of Fischer von Waldheim's "*Entomographia Imperii Rossici*" (Moscow, 1852) is devoted to *Nymphalinae*, of which several very interesting species are figured, in addition to commoner ones. Vols. i. and ii. (1820-1824) also contained figures of a few *Lepidoptera*.

Most of Eversmann's important contributions to Russian and Siberian Entomology are scattered through the "*Bulletin de la Société des Naturalistes de Moscou*," but his "*Fauna Lepidopterologica Volgo-Uralensis*" (Kasan, 1844), a useful book, though without illustrations, is an exception.

Iceland.

Dr. Staudinger has published a list of Moths (there are said to be no Butterflies in the island) in the "*Stettiner Entomologische Zeitung*," vol. xviii. for 1857.

Madeira.

The most important paper on the *Macro-Lepidoptera* of this island is Mr. Bethune-Baker's "*Notes on the Lepidoptera collected in Madeira by the late T. Vernon Wollaston*," published in the "*Transactions of the Entomological Society of London*" for 1891, with a coloured plate. A previous paper, with a similar title, was published by Stainton in the "*Annals and Magazine of Natural History*" (ser. 3, vol. iii. pp. 209-214) (1859); in addition to some descriptions of new species by Wollaston himself, in the "*Annals*" for 1858 (ser. 3, vol. i. pp. 18-28, 113-124).

Canaries.

A little book with four coloured plates, entitled "*The Butterflies and Moths of Teneriffe*," was published by Mrs. Holt White

in 1894. There is also a paper by Alpheraky, "Zur Lepidopteren Fauna von Teneriffe," published in Romanoff's "Mémoires sur les Lépidoptères" (vol. v. pp. 203-232, pl. 11) (1889), based upon the collections formed by the Grand Duke Nicholas Mikhaïlovitch and his suite during a visit to the island in 1887 (Cf. *postea*, p. 192.) There is also an important series of papers on the *Lepidoptera* of the Canaries, by Drs. Rebel and Rogenhofer, in the "Annalen des K. K. Nat. Hofmuesums" (of Vienna), the last of which was published in 1896. It is, however, understood that Mr. S. D. Crompton, of Orotava, is collecting materials for an exhaustive work on the subject.

Azores.

Mr. F. D. Godman, in his work on "The Natural History of the Azores" (1870), publishes a list of the extremely poor Lepidopterous Fauna of this group.

Algeria.

Some of the most interesting species of Algerian *Lepidoptera* were described and figured by Lucas in the "Exploration Scientifique de l'Algérie" (vol. iii. 1849). M. Oberthür has latterly devoted some parts of his "Études d'Entomologie" to the same subject.

Egypt and Palestine.

The Entomology of Egypt and Palestine has been strangely neglected. Klug has illustrated some Butterflies from Upper Egypt and Arabia in the "Symbolæ Physicæ" (Berlin, 1829-1845); there is a small paper by Walker in the "Entomologist" for 1870 (vol. v. pp. 51-57), and another on the *Lepidoptera* of the neighbourhood of Alexandria by Mr. Bethune-Baker ("Transactions of the Entomological Society of London," 1894, pp. 33-51, pl. 1), and this apparently accounts for nearly all the literature of the subject.

Oriental Regions :

Asia, excluding India, South China, Indo-China, and the Philippines and Indo-Malayan Islands.

As some of the books which must be discussed here trench upon the Indo-Malayan region proper, it is better to group them under a more general heading.

Persia.

A little book by Bienert, called "*Lepidopterologische Ergebnisse einer Reise nach Persien in den Jahren 1858 und 1859*" (Leipzig, 1870) gives an outline of the subject.

Turkestan.

Erschoff's work on the *Lepidoptera* obtained by Fedchenko, and published in the official reports on the expedition, contains coloured figures of many new and interesting species ; but, except the Latin diagnoses, the book is printed entirely in Russian.

Central Asia, &c.

The first six volumes of Romanoff's fine work, "*Mémoires sur les Lépidoptères*," published by H.I.H. the Grand Duke Nicholas Mikhaïlovitch Romanoff, are devoted chiefly, though not exclusively, to monographs on the *Lepidoptera* of outlying portions of the Russian Empire and the adjoining territories. The most important of these is vol. iv. (1890), which is entirely occupied by an essay by Groum-Grschimaïlo on "*Le Pamir et sa Faune Lépidoptérologique*."

Amurland.

There are two interesting works on the *Lepidoptera* of this district, both illustrated with coloured plates : Ménériés' work on the *Lepidoptera*, published in Schrenk's "*Reisen und*

Forschungen im Amurlande" (St. Petersburg, 1859); and Bremer's "Lepidopteren Ost-Siberiens" (St. Petersburg, 1864).

China, Japan, and Corea.

A great number of important papers by Butler, Leech, and Alpheraky have appeared in the "Annals and Magazine of Natural History," the "Cistula Entomologica," the "Proceedings of the Zoological Society of London," the "Entomologist," Romanoff's "Mémoires," and elsewhere. In addition to these, the following separate publications may be noticed.

In 1853 Bremer and Grey published at St. Petersburg a small pamphlet called "Beiträge zur Schmetterlings-Fauna des nördlichen Chinas." There are two issues of this, which only differ (even the date being the same) in the later one being printed on better paper, and containing references to twelve plates, of which only two are issued with it. The insects described in it were collected in the neighbourhood of Peking.

The late Mr. W. B. Pryer has published a book, called "Lepidoptera Nihonica" (Yokohama, 1886-1889), illustrating all the Butterflies. The letterpress is very scanty and insufficient, but is accompanied by a translation in Japanese.

In parts 2 and 3 of the "Illustrations of Typical Specimens of *Lepidoptera Heterocera* in the Collection of the British Museum" (1878 and 1879), Dr. A. G. Butler has figured a large number of Moths from China and Japan, many of which were previously described by him in the periodicals already referred to.

Nearly all the Butterflies of the countries under discussion are described and figured by Mr. J. H. Leech, in his "Butterflies from China, Japan, and Corea" (4to, 1892-1894), a large and comprehensive work not likely to be soon superseded.

ÆTHIOPIAN REGION.

In dealing with the African Continent I propose to notice first those works which refer to the west coast, and then the eastern. It is curious that though the west coast has been much more explored entomologically, till lately, than the east, most of the separate publications on African insects relate to the south and east, the published information respecting those of the west coast being much more scattered.

West Coast of Africa.

There is a small work published by Mr. W. Schaus and Surgeon-Captain W. G. Clements in 1891, "On a Collection of Sierra Leone *Lepidoptera*," with three coloured plates.

Jameson's "Story of the Rear Column" (1890) includes an article by Messrs. Godman, Salvin, and Druce, on the *Lepidoptera* taken on the Congo by the ill-fated author.

As regards the tropical islands, our information respecting the Cape Verdes is very incomplete. St. Helena is better known, a list of species having been published by Walker in Melliss's description of the island (1875); and a later and more complete list by Mrs. Wollaston, in the "Annals and Magazine of Natural History" for 1879.

South Africa.

A few species from South Africa were described or mentioned by Boisduval in 1847, in the Appendix to vol. 2 of Delegorgue's "Voyage dans l'Afrique Australe," and in 1849 Angas published a plate of *Lepidoptera* in his "Kaffirs Illustrated." Subsequently, papers descriptive of Wahlberg's collections were published at Stockholm in the "Vetenskaps Handlingar," the Butterflies and larger Moths by Wallengren

in 1853 and 1865 respectively, and the *Micro-Lepidoptera* by Zeller in 1852 (or 1854).

When Mr. Roland Trimen went to the Cape, he took up the study of Butterflies, and in addition to numerous papers, he has published two valuable works, "*Rhopalocera Africæ Australis*" (1862-1866), and "*South African Butterflies*" (1887-1889).

Oates's "*Matabele Land and the Victoria Falls*" (two editions, 1881 and 1889), includes figures and descriptions of many *Lepidoptera* by Westwood and Olliff; and there are also descriptions and figures of new species in Distant's "*Naturalist in the Transvaal*" (1892).

Madagascar, &c.

Apart from smaller lists and papers, there are no fewer than three very important publications on the *Lepidoptera* of Madagascar. These are Boisduval's "*Lépidoptères de Madagascar*" (1833); the first volumes on *Lepidoptera*, by Mabilie, in Grandidier's "*Histoire Physique, Naturelle, et Politique de Madagascar*" (1885 and 1887), containing the Butterflies; and Saalmüller's "*Lepidopteren von Madagascar*" (Frankfort-on-Main, 1884 and 1891), which, like Boisduval's work, includes both Butterflies and Moths.

Some species from Mauritius were included in Boisduval's books; but as regards one of the adjacent islands, a list of *Lepidoptera* by Guenée was included in the second volume of Maillard's "*Notes sur l'île de Réunion*" (1862).

Crossing to the east coast of Africa, the next important book which demands our attention is Peters' "*Reise nach Mossambique*." The fifth volume of Zoology (1862) is devoted to Insecta and Myriopoda, and includes a section on *Lepidoptera* by Hopffer. Further north, Gerstaecker, in Von der Decken's "*Reisen in Ost-Afrika*" (vol iii., pt. 2, 1873), has

given some account of the *Lepidoptera* of the Kilimanjaro district.*

The great French works on Abyssinia by Ferret and Galinier and Lefebvre, both published in 1849, contain descriptions and figures of many species of *Lepidoptera*.

INDIAN, INDO-MALAYAN, AND AUSTRO-MALAYAN REGIONS.

Works dealing generally with this Fauna are not very numerous. The earliest was, perhaps, Westwood's "Cabinet of Oriental Entomology" (1848), in which many species of Butterflies and Moths from India, Ceylon, Java, &c., were described and figured for the first time.

In 1857 and 1859, Horsfield and Moore published their "Catalogue of the Lepidopterous Insects in the Museum of the Hon. East India Company," with descriptions of new species, and notices of the transformations of many Butterflies, *Sphinges*, and *Bombyces*.

A more recent book of considerable value is Swinhoe's "Catalogue of Eastern and Australian *Lepidoptera Heterocera* in the collection of the Oxford University Museum. Part i.: *Sphinges* and *Bombyces*" (Oxford, 1892). This book is of importance because it contains figures and fuller descriptions of a considerable number of Walker's types, many of which passed into the Oxford Museum from the collection of W. Wilson Saunders.

A great number of valuable papers on the Butterflies of the Malay Archipelago were published by Dr. A. R. Wallace in the Transactions of the Entomological and Linnean Societies of London; and lists of the species of various islands, by Mynheer P. C. T. Snellen, are frequently published in the

* Several important papers on East African Lepidoptera have been published by Karsch, Oberthür, Mabille, Emily M. Sharpe, and others.

"Tijdschrift voor Entomologie." Snellen van Vollenhoven likewise published some useful papers in the early volumes of the Tijdschrift, and a monograph of Malayan *Pieridæ* as a separate work. ("Essai d'une Faune Entomologique de l'Archipel Indo-Néerlandais: Famille des Pierides." Hague, 1865.)

India.

Little was done by the early writers to elucidate the *Lepidoptera* of India; but in 1846 G. R. Gray published a small book called "Descriptions and Figures of some new Lepidopterous Insects, chiefly from Nepal," and about the same time Kollar described and figured a large number in Von Hügel's "Kaschmir."

After the publication of Horsfield and Moore's "Catalogue" referred to in the last page, there was a considerable increase in the interest taken in Indian *Lepidoptera*, and many important papers by Moore, Butler, Wood-Mason, De Nicéville, Hampson, and others, have appeared in the "Proceedings of the Zoological Society of London," the "Transactions of the Entomological Society of London," the "Journal of the Asiatic Society of Bengal," the "Journal of the Bombay Natural History Society," and elsewhere.

Besides these, various separate works were undertaken, such as the series of "Descriptions of new Indian Lepidopterous Insects from the Collection of the late W. S. Atkinson, M.A., F.L.S., &c.," published at Calcutta by the Asiatic Society of Bengal in 1879, 1882, and 1888. With the exception of an introductory notice by Arthur Grote, and four pages of descriptions of Butterflies figured on the first plate, by W. C. Hewitson, the work is wholly written by Mr. F. Moore, and relates to Moths.

Two very important works on Indian Butterflies are now in course of publication. One of these, "The Butterflies of India,

Ceylon, and Burma," was commenced by Colonel G. F. L. Marshall and Mr. De Nicéville, but is now continued by Mr. De Nicéville alone. It is in octavo, and is illustrated with plates and woodcuts, and three volumes, including the *Nymphalidæ*, *Lemoniidæ*, and *Lycænidæ*, have at present been published. The other work is Mr. Moore's "Lepidoptera Indica," in quarto, with coloured plates representing all the species, and the metamorphoses of many of them. This work extends at present as far as the genus *Euthalia*, Hübner (*Nymphaliniæ*).

A useful "Catalogue of the Moths of India, including Ceylon and Burmah," was published at Calcutta, in six parts, between 1887 and 1889, by the Trustees of the Indian Museum. It was edited by Messrs. Cotes and Swinhoe.

Subsequently to the appearance of this Catalogue, Sir George Hampson has issued four volumes in the series of works edited by Mr. W. T. Blanford, under the title of "Fauna of British India" (1892-1896), in which all the *Macro-Lepidoptera*, inclusive of the *Pyrales* and *Crambi* (which the author treats as sections of the same family) are described, and woodcuts given of the genera, illustrating the neuration, antennæ, &c. In addition to the works already mentioned, several volumes of the "Illustrations of Typical Specimens of *Lepidoptera Heterocera* in the Collection of the British Museum" (Parts 5-8, 1881-1893), written by Dr. A. G. Butler and Sir George Hampson, have been devoted to the Moths of India.

Ceylon.

Mr. F. Moore has completed a large work on "The *Lepidoptera* of Ceylon" (3 vols. 4to, col. plates, 1880-1887), in which the species and their metamorphoses are fully described and illustrated. The work on which he is now engaged, the "Lepidoptera Indica," is uniform with this book.

Part 9 of the "Illustrations of Typical Specimens of *Lepidoptera Heterocera* in the Collection of the British Museum," published in 1893, is devoted to the *Macro-Heterocera* of Ceylon, and is written by Sir George Hampson,

Malay Peninsula.

Two books may be noticed under this heading. In 1843 Delessert published his "Souvenirs d'un Voyage dans l'Inde," in which Guérin-Ménéville described and figured an interesting series of conspicuous Butterflies and Moths.

The Butterflies have since been very fully described and figured by Mr. W. L. Distant in his "Rhopalocera Malayana : a Description of the Butterflies of the Malay Peninsula," published in parts from 1882 to 1886.

Philippines.

A large work, edited by C. Semper, and entitled "Reisen im Archipel der Philippinen," is now in course of publication at Wiesbaden, the second series (Zweiter Theil) of which is devoted to "Scientific Results" (Wissenschaftliche Resultate). The *Lepidoptera* are edited by G. Semper ; and the Butterflies, forming vol. v. of the series, are now completed ; vol. vi. part 1, commencing the Moths, appeared in 1896. This book is notable on account of the prominence given to metamorphoses, both in the text and on the plates.

Java.

Under this heading we may include Horsfield's unfinished "Descriptive Catalogue of the Lepidopterous Insects contained in the Museum of the East India Company" (2 parts, 4to, 1828 and 1829), which was chiefly based on his collection and observations of the metamorphoses of the *Lepidoptera* of Java.

Sumatra.

There is a Dutch work, Veth's "Midden-Sumatra," which includes a long article on the *Lepidoptera* by Snellen (Leyden, 1880).

Nias.

This is a small island near Sumatra ; and the Butterflies are described by Napoleon M. Kheil in his "Rhopalocera der Insel Nias" (Berlin, 1884). It is a thin quarto, illustrated by five photographic plates, which are much better executed than photographic plates of insects usually are ; for this mode of illustration is rarely successful in the case of *Lepidoptera*.

Austro-Malayan Region.

Several members of the French exploring voyages during the early part of the present century made considerable collections of insects in this region. The most important of these, as regards *Lepidoptera*, was that formed under Admiral Dumont d'Urville, who was himself interested in Entomology. They furnished materials for a volume on *Lepidoptera*, by Boisduval, published in 1832 among the official reports of the "Voyage de l'Astrolabe," under the secondary title of "Faune Entomologique de l'Océan Pacifique : Lépidoptères." The report on the Entomological collections of the "Voyage de la Coquille," by Guérin-Ménéville, was published about the same time.

There is an important series of papers on the *Lepidoptera* of the Eastern Islands of the Malay Archipelago by Dr. A. Pagenstecher, in the "Jahrbuch des Nassauischen Vereins für Naturkunde," published at Wiesbaden.

Montrouzier's "Essai sur la Faune de l'île de Woodlark, ou Moïou," published in the "Annales de la Société d'Agricul-

ture de Lyon" (ser. 2, vols. vii. and viii.) includes *Lepidoptera*, and was published separately at Lyons in 1857.*

Australia.

The first work on Australian *Lepidoptera* subsequent to Donovan's, to which we have already referred (*ante* p. 165), was Lewin's "Prodromus of Entomology, or Natural History of the Lepidopterous Insects of New South Wales" (1805 and 1822). It is a small quarto volume, containing eighteen coloured plates, representing the transformations of as many species of Moths, and is still of considerable scientific value; in fact, several of the illustrations of Australian Moths in the Naturalist's Library have been taken from this book.

A later and much more elaborate work on a similar subject is Scott's "Australian *Lepidoptera*," which is a large folio book. Three parts were published in 1864 and 1865; but the work was then discontinued, in consequence of the death of the author, until a year or two ago, when a new series was commenced, edited by Mrs. Ford (a daughter of Mr. Scott), and A. S. Olliff. I regret to add that this important work appears to have been again interrupted in a similar manner, Olliff, a young man who was well known to English Entomologists, and who was doing very good work in Australia, having recently died.

Two useful little books on Australian Butterflies, illustrated by woodcuts, may here be mentioned: Olliff's "Australian Butterflies" (Sydney, 1889), and Anderson and Spry's "Victorian Butterflies" (2 parts, Melbourne, 1893 and 1894).

Besides these works, a great number of important papers on Australian *Lepidoptera*, by Scott, Miskin, Lucas, Tepper,

* Valuable essays on Papuan *Lepidoptera* have been published by T. Kirsch, in the Mitth. Zool. Mus. Dresden, and by the Hon. Walter Rothschild and Mr. H. Grose Smith in the "Novitates Zoologicæ."

Meyrick, and others, will be found in the "Proceedings of the Linnean Society of New South Wales," and other Australian journals.

New Zealand.

In 1874 Dr. A. G. Butler published a "Catalogue of the *Lepidoptera* of New Zealand," as part of a long-interrupted work, "The Zoology of the Voyage of the Erebus and Terror," incorporating references to all that was then known on the subject. Since then much progress has been made, but chiefly in journals, though we may notice Mr. George Hudson's "Elementary Manual of New Zealand Entomology" (1892), which includes descriptions and figures of *Lepidoptera*. Those interested in the subject should consult the "Transactions and Proceedings of the New Zealand Institute," published at Wellington, N.Z.

NEARCTIC REGION.

The literature of both North and South America is much older and more extensive than that of any other part of the world, except Europe. Perhaps the oldest book of importance relative to North America (and one frequently quoted by Linnæus), is Catesby's "Natural History of Carolina, Florida, and the Bahama Islands," which forms two folio volumes and an Appendix, first published in 1731, 1743, and 1748 respectively. There are several later editions in English, besides translations in Latin, French, German, and Dutch. Several North American Butterflies and Moths are figured in this book.

Another work, issued at the end of the last century, but of great and permanent value, is Abbot and Smith's "Natural History of the rarer Lepidopterous Insects of Georgia," published in two folio volumes in 1797. It contains 104 coloured plates, each representing the metamorphoses of a single species. Abbot

was a collecting naturalist who settled in Georgia, and sent over large collections of insects and drawings to Drury, Francillon (who appears to have acted as his agent), Swainson, and other Entomologists of the period. Many specimens apparently of his collecting are still preserved in the British Museum, the Dublin Museum, and elsewhere; and there are many volumes of his drawings in various libraries in England, on the Continent, and in America. Francillon's own set, from which Sir James Smith may have taken his selection (though apparently not in every case), is contained in sixteen large quarto volumes, representing not only insects of all orders, roughly classified, but Spiders and other Arthropoda. There are upwards of 300 plates representing metamorphoses of *Lepidoptera*, some of which exhibit interesting cases of protective resemblance.

In addition to Smith's work, some of Abbot's drawings were utilised in the preparation of Boisduval and Leconte's "Histoire générale et Iconographie des Lépidoptères et des Chenilles de l'Amérique septentrionale" (Paris, 1829-1842), a work no continued beyond the Butterflies, and the letterpress of which is not quite complete, even as far as the published plates are concerned.

Say's "American Entomology" (3 vols. Philadelphia, 1817-1828) contains several interesting species of *Lepidoptera*, though Say seems to have worked less at this order than at some of the others.

Dr. T. W. Harris's "Report on the Insects of Massachusetts Injurious to Vegetation" was an exceedingly important contribution to North American Entomology, and embodied numerous original observations by the author on the habits and transformations of *Lepidoptera*. There appear to have been two issues in 1841 and 1842, a new edition in 1852, and an illustrated edition, edited by C. L. Flint, in 1859.

We now come to two collective works which were very useful at the time of their publication, but which are now nearly obsolete : J. G. Morris's "Catalogue of the Described *Lepidoptera* of North America," published as a part of the "Smithsonian Miscellaneous Collections" by the Smithsonian Society of Washington, in 1860, and a "Synopsis of the Described *Lepidoptera* of North America. Part 1, Diurnal and Crepuscular *Lepidoptera*," which was published in the same series in 1862, but which was not continued. These were followed by Boisduval's "*Lépidoptères de la Californie*," published in the "*Annales de la Société Entomologique de Belgique*," and reprinted separately in 1869.

Of late years the study of the *Lepidoptera* of North America has received an enormous extension; and the catalogues, monographs, and papers published in journals are far too numerous to mention. Some of the principal writers on North American *Lepidoptera* within the last thirty years have been Beutenmüller, H. and W. H. Edwards, Fernald, Grote, Lintner, Packard, Riley, Robinson, Scudder, Smith, Strecker, Stretch, and Lord Walsingham; but some of the most voluminous of these authors, such as A. R. Grote and J. G. Smith, have written chiefly in journals.

We can here only attempt to notice a few of the largest and most important works.

Commencing with Butterflies, Mr. W. H. Edwards' "Butterflies of North America," remarkable for its careful studies of life-histories, has been appearing in parts at intervals ever since 1868, and is now in its third volume. Dr. S. H. Scudder's "Butterflies of New England" (3 vols., Cambridge, Mass., 1888 and 1889), is an exceedingly elaborate and exhaustive work on a comparatively limited subject, dealing with every aspect of butterfly life (at least, as far as it relates to the locality) in the fullest possible manner. It is amply illustrated

with plain and coloured plates, maps, portraits, &c. It was preceded by Maynard's "Butterflies of New England" (Boston, 1885 and 1886), a quarto volume with coloured plates.

Strecker's "*Lepidoptera: Rhopaloceres and Heteroceres*" (Reading, Pennsylvania, 1872-1877), contains a considerable number of figures, chiefly, though not quite exclusively, of North American *Lepidoptera*. The series of figures of species belonging to *Lycaena*, *Polyommatus*, *Smerinthus*, and their allies are perhaps the most useful.

Stretch's "Illustrations of the *Zygænidæ* and *Bombycidæ* of North America," a small but beautifully illustrated book, not continued beyond the first volume, was published at San Francisco from 1872 to 1874.

Two large quarto works by Dr. A. S. Packard require special notice. The "Monograph of the Geometrid Moths or *Phalænidæ* of the United States" was published at Washington in 1876 as vol. x. of Hayden's quarto "Reports of the United States Geological Survey of the Territories." This work is illustrated with numerous plates of Moths, larvæ, neuration, and details.

Another very elaborate work, published in 1895, is Packard's "Monograph of the Bombycine Moths of America North of Mexico; including their Transformations and Origin of the Larval Markings and Armature. Part 1, Family I. *Notodontidæ*."

We have already noticed this volume (*anteà*, pp. xl.-xlii.), and have only to add that such work as has been lately produced in America by men like W. H. Edwards, A. S. Packard, and S. H. Scudder, goes far beyond almost everything that has been accomplished in Europe, where Entomologists seem to have neither time nor opportunity to carry out their work on anything like the same scale of completeness.

Among the numerous smaller works which are constantly appearing in America, Fernald's "Synopsis of North American

Crambidae, published in January, 1896, by the Massachusetts Agricultural College, may be specially noticed.

We will close our notice of the literature of the Nearctic Region with that of two essays published by one of our own countrymen, Lord Walsingham, who is chiefly interested in the *Micro-Lepidoptera*, and who, some years ago, undertook an expedition through the Western States of America, adding to his collection of insects on every opportunity.

Part 4 of the "Illustrations of Typical Specimens of *Lepidoptera Heterocera* in the British Museum" consists of a treatise on North American *Tortricidæ* by Lord Walsingham, largely augmented from his own collections in California and Oregon.

In 1880 Lord Walsingham published a smaller work on the *Pterophoridaæ* of California and Oregon.

The principal American writers on *Micro-Lepidoptera* have been Brackenridge Clemens, Robinson, Fernald, and V. T. Chambers. The collected papers of Clemens (unfortunately so far only as they relate to *Tineæ*) were reprinted by Stainton in 1872 under the title of "The *Tineina* of North America."

NEOTROPICAL REGION.

Mr. W. Schaus has commenced a work entitled, "American *Lepidoptera*: Illustrations of New and Rare Species" (London, 1892), but as yet only one part has appeared.

Mexico and Central America.

The one great entomological undertaking of which England may be really proud is Messrs. Godman and Salvin's "Biologia Centrali-Americana," the zoological portion of which, commenced in 1879, takes in the fauna of all the countries between the northern frontier of Mexico and the Isthmus of Panama. At present, the second volume of *Lepidoptera*

Rhopalocera, by the editors, and the second volume of *Lepidoptera Heterocera*, by Mr. H. Druce, are both approaching completion.

West Indies.

Jamaica.

As early as 1725, Sir Hans Sloane published the second volume of his "Voyage to the Islands Madeira, Barbadoes, Nieves, St. Christopher's and Jamaica," in which several species of *Lepidoptera* are recognisably figured, including the splendid *Cydimon sloanus* (cf. our vol. iii. p. 48, pl. 73, fig. 2), which was afterwards named after him.

There is no comprehensive work on the *Lepidoptera* of Jamaica, though they are fairly well-known; but only lists of species, sometimes with descriptions and figures of new ones, published in various periodicals by Gosse, Butler and Möschler.

Porto Rico.

H. B. Möschler, at the time of his death, left a paper of considerable length, entitled "Die Lepidopteren-Fauna von Porto Rico," which was published at Frankfort-on-Main, in 1890, by his friend, Lieut. Saalmüller, in the "Abhandlungen der Senckenbergischen naturforschenden Gesellschaft," in which periodical several of Möschler's papers had previously appeared, including his "Beiträge zur Schmetterlings-fauna von Jamaica," which was published in 1886.

Cuba.

It is curious that this island is the only one of the Antilles of which the *Lepidoptera* have been at all adequately worked at; for though the *Lepidoptera* of Jamaica and Haiti are equally well known, the information respecting them is scattered through various books and periodicals, as is also the case with the

published information relative to the *Lepidoptera* of some of the smaller islands. But on the insects of Cuba we possess both books and papers.

The earliest works of importance are those of Prof. Phelipe Poey, especially his "Centurie des Lépidoptères de l'île de Cuba" (Paris, 1833), and his "Memorias sobre la historia natural de la Isla de Cuba" (Habana, 1877); the latter contains several papers on *Lepidoptera*. In 1857, Ramon de la Sagra published a volume relating to "Animaux articulés," in his "Histoire Physique, Politique, et Naturelle, de l'Isle de Cuba," which contained a long list of *Lepidoptera*, drawn up by Lucas, in which many species were described as new, and some figured. In 1864 and 1865, a series of papers were commenced almost simultaneously by Mr. A. R. Grote and Dr. Herrich-Schäffer in the "Proceedings of the Entomological Society of Philadelphia," and in the "Correspondenzblatt des zoologisch-mineralogischen Vereins in Regensburg." The contents of the last series of papers were afterwards incorporated and amplified in Gundlach's "Entomologia Cubana" (1881).

South America.

A considerable number of new species of Butterflies and Moths are figured in the following work: "Lepidopteren gesammelt auf einer Reise durch Colombia, Ecuador, Peru, Brasilien, Argentinien und Bolivien, in den Jahren, 1868-1877, von Alphons Stübel. Bearbeitet von Gustav Weymer und Peter Maassen," Berlin, 1890.

Guiana.

The oldest and one of the most important works on the insects of South America, including the metamorphoses of many *Lepidoptera* (though the larvæ are sometimes referred to the

wrong insects), is Madame Merian's "Metamorphosis Insectorum Surinamensium," a large folio volume, published at Amsterdam as early as 1705, of which there are many later editions in Latin, Dutch, and sometimes French.

A later Dutch work on the same subject is Sepp and Scheller's "Surinaamsche Vlinders" (3 vols. Amsterdam), which appears to have been published at intervals between 1828 and 1852, and notwithstanding the late date of the book, the Linnean nomenclature is still retained in it.

There is also a series of papers by Möschler, on the *Lepidoptera* of Surinam in the "Verhandlungen der zoologischen-botanischen Gesellschaft in Wien" (from 1876 to 1883).

Several *Lepidoptera* are described in vol. iii. of Schomburgk's "Reisen in Britisch Guiana" (Leipzig, 1848).

Brazil.

There are two books of scientific travels which contain Brazilian *Lepidoptera*. One of these is Humboldt and Bonpland's "Recueil d'Observations de Zoologie et d'Anatomie Comparée" (Paris, 1811 and 1832), both volumes of which contain papers on the Order by Latreille; and Perty's "Delectus animalium articulatum" (Munich, 1834), which forms one of the series of works embodying the scientific results of the journey of Drs. Spix and Martius.

Ecuador and Bolivia.

Among the series of pamphlets containing diagnoses of Butterflies by Hewitson are some entitled "Equatorial *Lepidoptera* collected by Mr. Buckley" (five parts, 1869-1877), and "Bolivian Butterflies collected by Mr. Buckley" (1874). Many of the species therein described were afterwards figured by Hewitson in the later parts of his "Exotic Butterflies."

Of late years M. R. Dognin has received many new species from Ecuador, of which he has published diagnoses in "Le Naturaliste."

In 1887 he published a quarto pamphlet, with coloured plates, entitled "Note sur la Faune des Lépidoptères de Loja (Équateur) et descriptions d'espèces nouvelles;" and in 1891 and 1894 he issued two more parts under the altered title of "Lépidoptères de Loja et environs (Équateur) : Descriptions des espèces nouvelles."

Argentine Republic.

Professor Burmeister devoted vol. v. of his "Description physique de la République Argentine" (1878), to *Lepidoptera* (Butterflies, *Sphinges*, and part of the *Bombyces*). This work is in octavo, but he subsequently published two parts of an atlas of *Lepidoptera* in quarto, including, besides figures of many perfect insects and their metamorphoses, letterpress in the same form embodying a large amount of additional information.

Chili.

The *Lepidoptera* of Chili are fairly well known. In 1852 a considerable number of species were described and figured by Blanchard in vol. vii. of Gay's "Historia de Chile : Zoologia," and many papers on the subject have since been published in various European and Chilian journals by Philippi, Butler, Bartlett-Calvert, and others. Mr. Edwyn C. Reed has also published a synopsis of Chilian Butterflies, illustrated by three plates, under the title of "Una Monografia de las Mariposas Chilenas" (Santiago de Chile, 1877).

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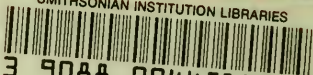
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